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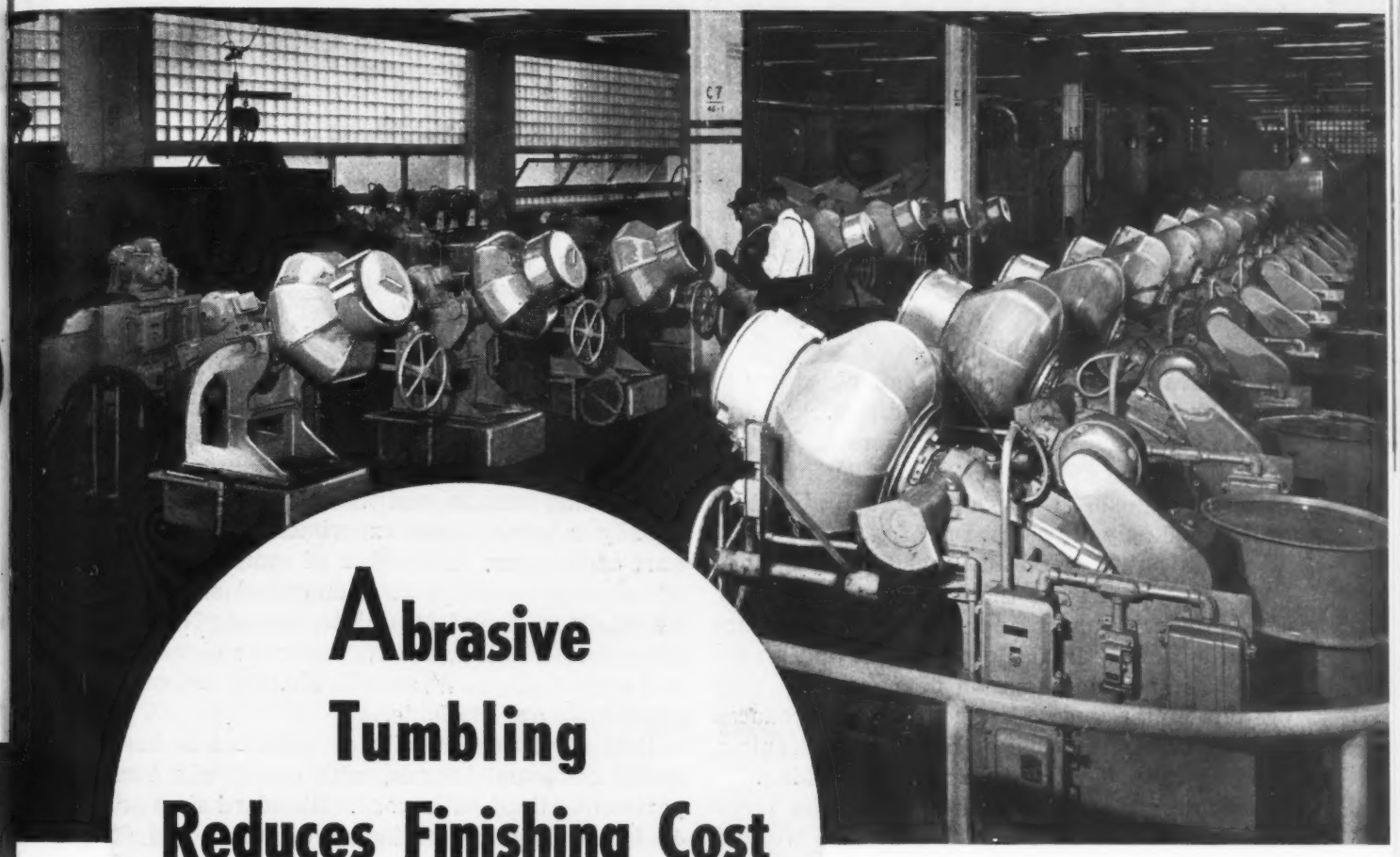


Abrasive Tumbling Reduces Finishing Cost

By VALLORY H. LAUGHNER

Deburring, Cleaning, and Finishing Operations, Both in Job Shops and High-Production Plants, are being Performed Increasingly by the Abrasive Tumbling Process

ABRASIVE tumbling, while similar to ordinary tumbling processes in so far as procedure is concerned, differs in that it utilizes aluminum-oxide grit, and has the advantage that the results can be more precisely controlled. By varying the size of the grit, the amount of water in the barrel, and the type of tumbling compound used, it can be adapted either to improve micro-inch finishes or to remove an appreciable amount of material from parts. The work handled ranges in size from large steel forgings, weighing 25 pounds or more, to small hardware fittings of fractional-inch dimensions. For the most part, this process is used on cast iron, steel, aluminum, magnesium, and copper, but it is also applied to a limited extent on the so-called precious metals—platinum, gold, and silver.

Any of several operations can be performed, including cleaning of castings, removal of scale from heat-treated parts, forming of pieces to uniform radii, or finishing of high-precision work. It can also be applied for removing paint and electrolytic plates or for reducing over-sized parts of soft metal to pass inspection. A considerable saving in time, labor, and materials can be realized, but equally important is the elimination of scrap and of reworking.

A number of factors can be varied to obtain the desired results. For example, aluminum-

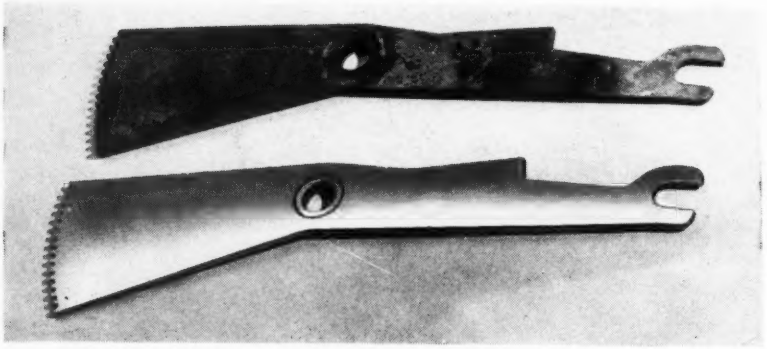


Fig. 1. Abrasive Tumbling is Used to Remove the Heat-treating Scale on This Small Steel Subassembly. The Two Views Show the Part before and after Tumbling

oxide abrasives generally are available either in a tumbled or an untumbled condition. An untumbled abrasive has sharp corners and edges that give a fast cutting rate of cut, but produce a rougher finish. Consequently such abrasives are applied only for a first run or roughing operation. If only untumbled abrasive is available, it can be converted to the tumbled condition by a preliminary run of approximately two hours on grits ranging in size up to No. 3, and a subsequent run of one hour on finer grades. This pre-tumbling rounds off all corners and produces a block crystal capable of deburring, cleaning, forming radii, finishing, and superfinishing.

It is important that the abrasive be large enough or small enough not to become wedged in the work when finishing recesses, angles, fillets, and slots. At times two sizes may be necessary—a smaller size to reach the recesses and a larger one to add weight and push the particles through the work. As the grit wears, it can be resized and used for jobs requiring a finer abrasive.

In general grit sizes from No. 00 to No. 3 are used for such work as roughing, forming radii, deburring, surface finishing, and removing paints or electrolytic plates. Finer sizes are applied for finishing high-precision work and tumbling threaded parts; the finer grits, mixed with larger ones, are employed to reach recessed edges and surfaces. Grit sizes and types of abrasives commercially available are listed in Table 1.

Another factor controlling the results is the amount of water used in the tumbling operation. Decreasing the amount of water reduces the time cycle, but gives a rougher finish; while increasing the amount of water retards the grinding action, but produces a smoother finish. Often the initial operation is run at low-water level for rapid grinding or roughing, and more water is added for the finishing operation.

To the water and abrasive must be added a cleaning compound, the type depending on the metal being tumbled and the color desired. This usually requires some experimentation on the part of the user. A number of compounds that have worked well on steel and steel alloys are Sturgis Nos. 10 and 11, Oakite, Permag No. 168, Wyandotte No. R-2, and Neosuds; for aluminum and copper alloys, Wyandotte No. 317 and other compounds are available.

Best results can usually be obtained in horizontal octagonal barrels, with one to six compartments, lined with wood. Standard sizes are 45 inches long by 32 inches diameter and 60 inches long by 32 inches diameter.

Most of the barrels are designed to operate between 21 and 24 R.P.M. Some, however, are equipped with variable-speed motors. The International Business Machine Corporation's plant at Poughkeepsie, N. Y., to name but one, has found variable-speed barrels useful in processing delicate parts. For such work, a very low speed is employed—as low as 5 R.P.M., using a 60-inch barrel. With this speed, there is little distortion of the work. Of course, such a low operating speed is employed only for very delicate parts. Even with slow-speed operation, the savings in time over faster methods that require subsequent hand straightening operations or tumbling limited quantities in smaller tilting barrels are considerable.

At the Endicott, N. Y., works of the corporation, extensive use is made of tilting barrels. The installation of 43 machines includes eight standard Sturgis Roto-Finish barrels, three Globe tilting barrels, and 32 barrels such as shown in the heading illustration that were fabricated at

the plant. All are lined either with wood or with Neoprene, and each is equipped with an electric timing device that stops the operation after a predetermined time.

At present, the plant is tumbling over 8500 different parts, and is constantly adding to this number; the average weekly output of tumbled parts is 4,000,000. These range in size from small screws, washers, and rivets to machined castings measuring 2 1/4 by 4 3/4 by 27 inches and weighing 17 pounds.

One small part is the beam sub-assembly illustrated in Fig. 1. Before being tumbled, this part is covered with a heavy heat-treating scale—so heavy that it cannot be removed by a single tumbling operation. The part is subjected to a preliminary operation in an aggregate consisting of a sealing compound, Alundum, and hot water. After rinsing, it is tumbled again for thirty minutes in Alundum, soap, and cold water; finally it is removed and tumbled in Maixo for five minutes. The final results are shown in the lower view of the illustration.

The soft steel contact plunger shown in Fig. 2 represents an example of how costs can be reduced by the application of abrasive tumbling. Owing to the smooth finish required this piece was originally form-ground after it had been broached and hardened. While this method produced a satisfactory finish, the cost was high. By the application of tumbling, the costs were reduced and the finish maintained at a comparable level. The part was tumbled twice; once after broaching, to smooth up the surfaces, and once after hardening, to burnish and polish. The time for these operations totaled 9 1/4 hours, with 15,000 pieces in the barrel and a tumbling speed of 20 R.P.M.

The instructions to the men in the tumbling department are both verbal and written. The instruction card for each part contains not only a record of the tumbling procedure, but also information concerning any trouble that has been encountered on previous orders.

In spite of the large weekly output of 4,000,000 parts, scrap costs average less than $20 a week.

Fig. 2. A High Finish is Obtained on the Soft Steel Plunger Here Illustrated by the Tumbling Process, as Shown in Lower View

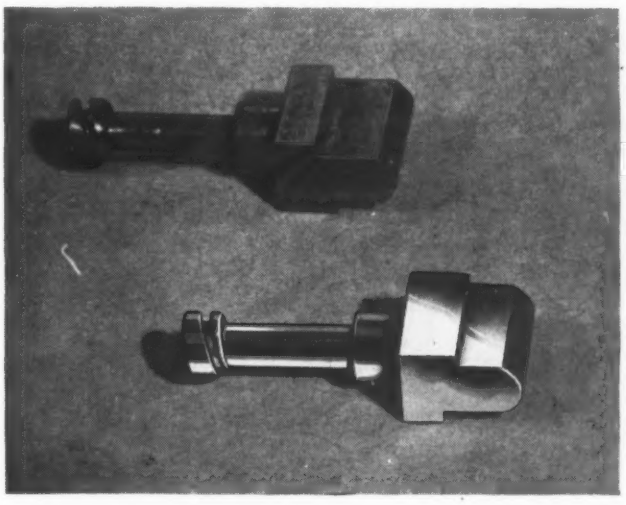
Table 1. Grit Sizes of Alundum Tumbling Abrasives

Grit Number	Average Particle Size, Inches	Type of Grain
00	1 1/2 to 2	Tumbled or Untumbled
0	1 to 1 1/2	Tumbled or Untumbled
1	3/4 to 1	Tumbled or Untumbled
2	1/2 to 3/4	Tumbled or Untumbled
3	1/4 to 1/2	Tumbled or Untumbled
4	3/16 to 3/8	Tumbled
6	1/8 to 3/16	Tumbled
8	3/32 to 1/8	Tumbled

This is a much better quality record than could be expected by hand-burring methods, and in addition represents a saving of over 3000 man-hours per week.

The Wood-Ridge, N. J., plant of the Wright Aeronautical Corporation uses abrasive tumbling entirely to deburr and form uniform radii on a variety of aircraft-engine parts; in no case has the finish of a precision part been found to be impaired. In many cases, the appearance of the part is not so bright as before tumbling, but the surface roughness reading, measured in micro-inches r.m.s., is less. While the process breaks edges and removes the burrs, the amount of material removed from the surface of the part is generally so small that it cannot be measured.

Briefly, the cycle consists of tumbling to the prescribed time, as determined by tests; dumping the load or removing the part by hand; rinsing with water; drying in the air; and dipping in



No. 4 slushing oil to prevent corrosion. All other factors being equal, the load in the barrel depends on the size and type of the part; it is entirely independent of the weight. For example, large parts, such as the counterweight shown in Fig. 3, that measure 6 inches in over-all length or diameter and are casehardened are tumbled one at a time in a six-compartment barrel; a considerable number of such carburized parts are processed.

The equipment consists of two-, three-, five-, and six-compartment barrels, and of two small tilting barrels used to tumble small-sized pieces. Also in the tumbling room is a separator, shown in Fig. 4, for grading the abrasive into different sizes, and other miscellaneous auxiliary equipment.

The abrasive and tumbling compound is loaded into the barrel by an electric hoist, as illustrated in Fig. 5. The total load in all cases, regardless of the number of parts being handled, reaches a level up to one-half or two-thirds of the inside diameter of the barrel or compartment. Before loading the parts, they are dipped in Varsol, a cleaning agent that removes most of the oil and grease accumulated during punching or machining. This is necessary only on parts that have a sufficient amount of grease on them to retard the abrasive action.

The time cycle is determined largely from experience. A record is kept of all jobs, including kind of part tumbled, material, water level, abrasive and compound, load, barrel, type of work, and time required. This file not only gives information of value when the job is repeated, but also serves as a guide on new parts. The only other method of determining operating conditions would be to run the part and check it periodically until the desired results were obtained.

After a run is completed, the parts are removed from the barrel by hand (if large) or the load is dumped and the parts separated from the mass by hand or by magnetic separators. Fig. 7 shows a small magnet being used for this purpose. The barrels are then rinsed and filled with water to prevent the wood lining from drying out.

Reports from the Wright Aeronautical Corporation indicate that tumbling has reduced production costs materially. Where parts are now finished uniformly, and the only labor involved is for loading, they previously had to be finished by hand, requiring the services of a skilled oper-

Fig. 3. Typical Parts Tumbled at the Wright Aeronautical Corporation, Including a Counterweight, Master Connecting-rod, Valve Rocker Arms, Small Bolts, Rings, and Hardware for Aircraft Engines

Fig. 4. Separator in which Grits are Automatically Graded for Size. The Particles are Placed in the Machine at the Top, are Segregated by Various Sizes of Wire Mesh, and Fall into the Bins Shown in the Foreground

ator. As shown in Table 2, many different kinds of parts and materials are deburred by this method. There is very little wear of the abrasive, the same grits being used many times before resizing is necessary. In the case of the master connecting-rod, the same grits are used for 200 hours before being dumped.

One thing noticed is that very heavy burrs or beads cannot be removed unless previously broken on a handwheel, nor can small parts with little passages be processed satisfactorily without supplementary hand-grinding operations. For example, a burr can be removed from the addendum sections of small gear teeth, but cannot be removed satisfactorily from the roots of the teeth if the burr is heavy.

However, larger gears can be deburred in a fraction of the time formerly required by hand methods. Burrs and heat-treating scale are removed, uniform radii are formed to blueprint specifications, and a high-grade finish is produced on each gear.

It should be pointed out that the abrasive tumbling of gears does not damage the tooth form. This has been determined by careful inspection of the involute form, and by checking the run-out of the gear. Although the normal tumbling cycle does not exceed six hours, a gear tumbled as long as sixteen hours showed no change in involute.

An entirely different class of work is done at the P. & F. Corbin plant in New Britain, Conn.

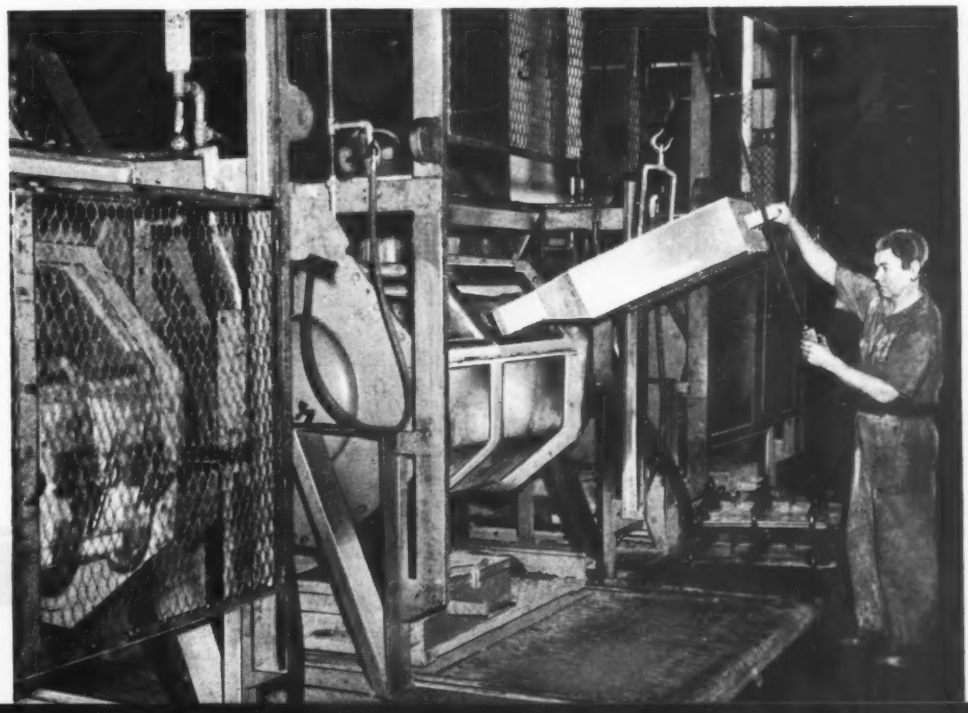


Fig. 5. Loading a Two-compartment Barrel with Abrasive Grits prior to Tumbling. The Same Grits Can be Used Many Times before Resizing is Necessary

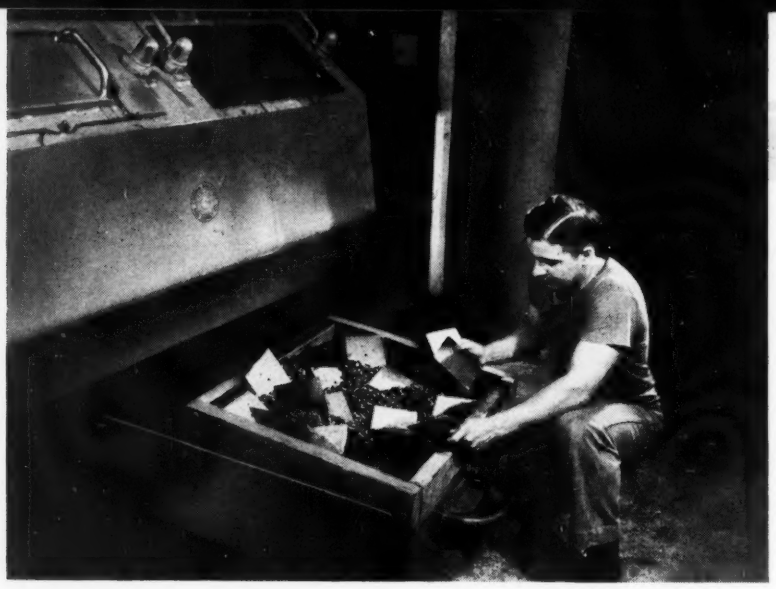


Fig. 6. Separating Work and Abrasive at the Conclusion of the Tumbling Operation. Larger Pieces are Separated without Dumping the Load from the Barrel

This company, which manufactures locks and builders' hardware, is concerned primarily with small parts. The equipment used at present consists of Henderson steel barrels, 5 feet long by 24 inches in diameter. These barrels are rotated at 21 R.P.M.

Abrasive tumbling operations are performed on iron, brass, and bronze castings for several purposes: (1) To reduce over-size parts to pass inspection; (2) to prepare brass and bronze castings for ball burnishing; (3) to prepare iron castings for plating; and (4) to deburr machined steel parts and steel stampings.

The work tumbled is of many different types, sizes, shapes, and weights. The weight and contour of the part determine to a large degree the

Table 2. Data on Typical Parts Finished by Abrasive Tumbling

Part	Material	Operation
Master Connecting-Rod for Aircraft Engine.....	AMS 6412 (Nickel-Chromium-Molybdenum Steel; S A E 4337)	Deburr and break edges
Counterweight for Aircraft Engine.....	AMS 5024 (Manganese Steel; S A E 1137)	Break edges 0.02 to 0.04 inch
Aircraft-Engine Bushing	AMS 6250 (Carburizing Steel; S A E 3310)	Deburr and break edges
Spider Gear	AMS 6322	Break edges 0.003 to 0.015 inch
Cylinder-Head Air Deflector	AMS 5516 (18-Chromium 8-Nickel Steel; S A E 30915)	Finish all over
Bolt Bushing	AMS 4632 (Hard Aluminum Bronze)	Deburr
Supercharger Cover	AMS 4484-A (Magnesium Alloy; S A E 503)	Break sharp edges 0.003 to 0.015 inch
Lapping Ring	AMS 7310 (Cast Iron)	Finish all over

Fig. 7. A Hand Magnet is Employed to Separate Small Ferrous Metal Parts from the Abrasive Particles upon the Completion of the Tumbling Operation

proportion of abrasive grit to work. The same is true of the time cycle for tumbling a particular part. It is obvious that if a contour is to be maintained, the time cycle must be shorter.

All operations are performed with untumbled Alundum abrasive, No. 0 size. When the particles wear down, they are removed, sorted, and added to the No. 0 size on rolling operations where small radii must be cleaned, but where the smaller grits will not lodge in recesses in the part.

Generally, the proportion of abrasive to work is three to one. With the average part, this allows about five to eight shop boxes of work in each barrel. However, when large castings are tumbled, it is often necessary to increase the abrasive-work ratio to five to one. Water is added in the barrel to the level of the mass, but further

Table 2. Data on Typical Parts Finished by Abrasive Tumbling (Continued)

Compartments in Barrel	Capacity, Number of Parts per Compartment	Aggregate	Amount of Water Used	Time, Hours
2	3	650 lbs. No. 3 Alundum Abrasive 8 lbs. No. 10 or 12 Sturgis Compound 4 oz. No. 5 Oakite	2 to 5 inches above mass	1/4
6	1	125 lbs. No. 2 Alundum Abrasive 125 lbs. No. 4 Alundum Abrasive 2 lbs. No. 10 or 12 Sturgis Compound 2 lbs. No. 168 Permag Cleaner	Level with mass	3
2	25	500 lbs. No. 6 Abrasive 4 oz. No. 6 Oakite	Level with mass	2
5	1	250 lbs. No. 5 Abrasive 4 lbs. No. 10 or 12 Sturgis Compound 4 oz. No. 5 or 6 Oakite	2 to 5 inches above mass	1
6	50	100 lbs. No. 20 Borolon 100 lbs. No. 5 Alundum Abrasive 4 lbs. No. 10 or 12 Sturgis Compound 4 oz. No. 5 or 6 Oakite	2 to 5 inches above mass	1/2
2	225	400 lbs. No. 6 Alundum Abrasive 5 lbs. No. 10 Sturgis Compound 4 oz. No. 6 Oakite	Level with mass	1 1/2
3	40	350 lbs. No. 6 Alundum Abrasive	2 to 5 inches above mass	1/4
3	34	400 lbs. No. 5 Alundum Abrasive 3 lbs. No. 168 Permag Cleaner	Level with mass	3

experimentation may indicate that this level can be reduced.

Brass and bronze parts are rinsed in the barrels, after which they are separated from the abrasive. This sorting operation is done on a conveyor belt. The mass is dumped into a large hopper which feeds the conveyor belt, and the parts are sorted manually by an operator. The grit is carried on and dumped into boxes at the end of the conveyor.

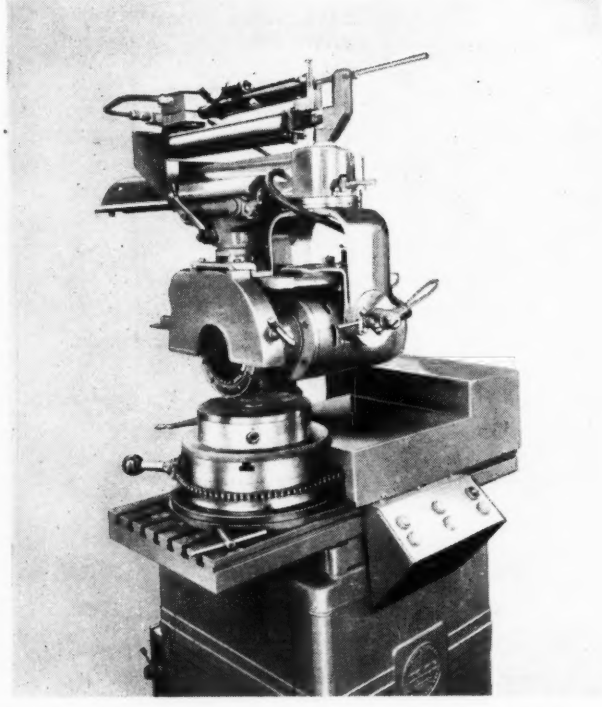
Iron castings and other ferrous material being prepared for plating are rinsed thoroughly in the barrels after the tumbling cycle. Then soda and more water are added, and the parts are rolled for three hours. The barrels are now emptied and the load dumped into the hopper and fed to the conveyor. There the work is separated from the abrasive by a magnetic pulley under the conveyor belt.

Metal stampings that require no machining or other operations after abrasive tumbling are placed in tilted octagonal barrels and rolled in Tumble-Brite or a similar compound for approximately one hour.

Inasmuch as the Corbin plant has not definitely established operation sheets for its tumbling processes, some of the procedures described may change as experience and additional equipment are secured. By the process now in use, however, tumbling time has been reduced considerably over the previous method of rolling with trap-rock, sand, and water.

Rapid Method of Producing Powdered-Metal Aircraft Parts

GROOVING operations on powdered-metal aircraft parts are being performed four times faster by the conversion of a standard Walker-Turner radial cut-off machine to an automatic grooving unit at the plant of the S. K. Wellman Co., Cleveland, Ohio. The cut-off machine is equipped with a diamond-impregnated metal wheel and a magnetic chuck mounted on an automatic index table.



Radial Cutting-off Machine Equipped for Grooving Powdered-metal Aircraft Parts

The sliding head of this machine is actuated by an air cylinder. This head moves outward, cutting a groove 1/8 inch wide by 0.010 inch deep in the powdered-metal disks and automatically returns to its initial position. The indexing of the table for cutting eight radial grooves in each side of the disk is electronically controlled. A production rate of three pieces per minute is maintained.

Very accurate work can be done with this setup, the groove depth being held to a 0.003-inch limit, while the accuracy of the indexing is held to 0.005 inch. A 10-inch diameter wheel operating at a speed of 3000 R.P.M. with a feed of about 120 inches per minute is used. The powdered-metal disk is bonded to each side of a steel core having an internal spline. It has an outside diameter of 5 inches, an inside diameter of 3 inches, and a thickness of 1/16 inch.

Making the "Christmas Tree" Express

By CHARLES H. WICK

Pressed and Die-Cast Metal and Plastic Replicas of Real Trains are being Turned out on a Mass Production Basis by the Lionel Corporation, Irvington, N. J., to Delight Thousands of Small Boys at Christmas

TOY electric trains that are exact replicas of full-size railroad trains are being turned out at the plant of the Lionel Corporation, Irvington, N. J., by the use of production equipment, some of which is especially designed for the purpose. Several of the manufacturing operations used in producing these miniature trains are of interest.

There is a wide range of choice in the materials used in making the toy trains. For example, the cars may be made of light sheet metal or molded plastics; the locomotives are of die-cast metal; and the locomotive wheels are pressed from powdered metal. The latitude in the choice of materials sometimes enables substantial savings to be effected. An example is the new plastic caboose which trails the freight train through the "winter wonderland." Formerly made from sheet metal in a series of forty press operations, two of these cars are now produced from plastic, with more detail than former models, in one "shot" on an injection molding machine.

A production of 70 "shots" or 140 cabooses per hour is attained on the Watson-Stillman injection molding machine shown in Fig. 1. Although these cars only contain about 2 2/3 ounces of plastic each, a 16-ounce capacity machine is employed to obtain the die area necessary for multiple-cavity molding. An injection pressure of 22,500 pounds per square inch and a clamping pressure of 385 tons are obtained on this 30-H.P. hydraulic machine. The molds are chromium-plated to minimize sticking and wear, and to produce a high finish on the work.

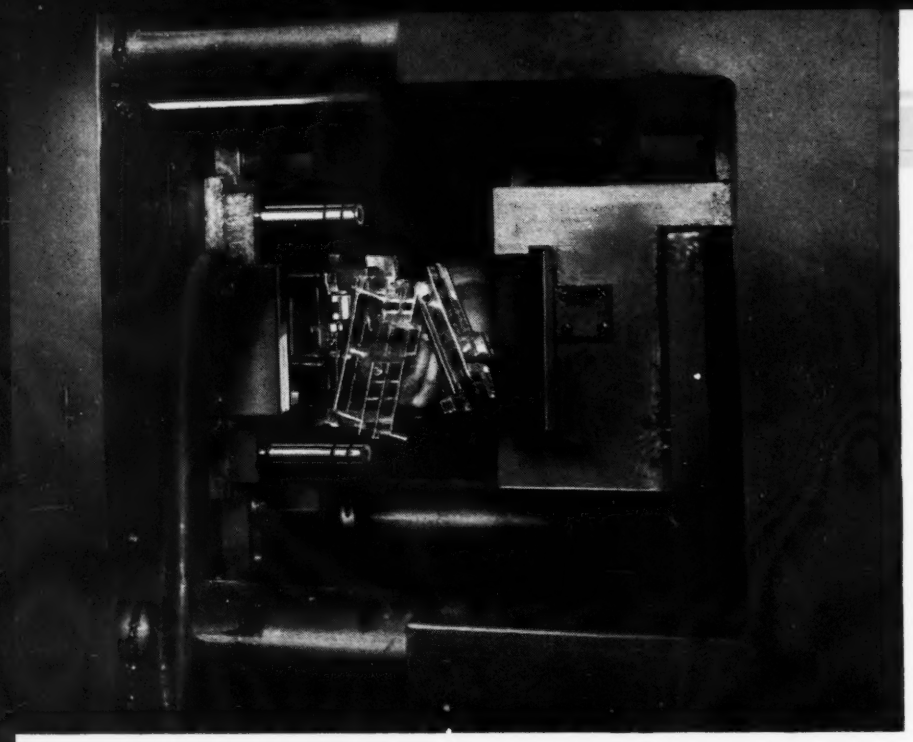


Fig. 1. Plastic Caboose Cars for Toy Freight Trains are Injection Molded in a Double-cavity Mold at the Rate of 140 per Hour

Other passenger and freight cars, as well as cabooses, are made from injection moldings of thermoplastic materials such as polystyrene. Thermosetting plastics, as, for example, Bakelite, which are employed for electrical parts and controls, are compression molded from preformed tablets.

Finishing operations performed on molded plastic parts vary with the product, but usually include flash and gate removal, filing, buffing, drilling, and painting. Flash is removed by rotating the parts at 20 R.P.M. for several minutes in a tumbling barrel charged with wooden pegs. When a good finish is required, the wooden pegs are coated with wax. Drilling is accomplished with carbide-tipped drills having large polished flutes and tips that are ground to a 56-degree included angle.

Ties, which hold the three rails in their respective positions and form the base of each track section, are stamped from cold-rolled steel strip stock, 0.022 inch thick by 1 5/16 inches wide. The progressive stamping, piercing, notching, forming, and cut-off die used for this purpose is mounted on a Waterbury-Farrel straight-sided 40-ton punch press, as shown in Fig. 2. A track tie is produced at each stroke of the ram, giving a production of 10,000 per hour. Lubricating oil made from lard and sulphur drips on the strip stock as it is automatically fed into the die.

Referring to the drawing of the progressive die, Fig. 3, the strip steel is pierced by punches *P* and imprinted by stamp *S* at the first station. At the second station, three I-shaped openings are pierced in the stock by punches *B* and the

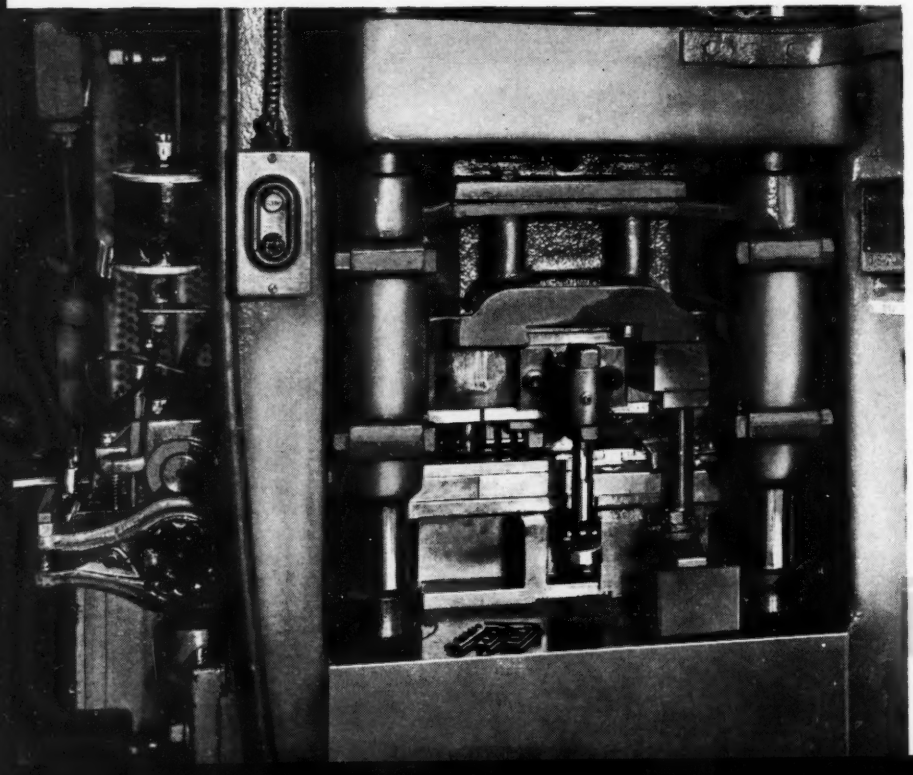
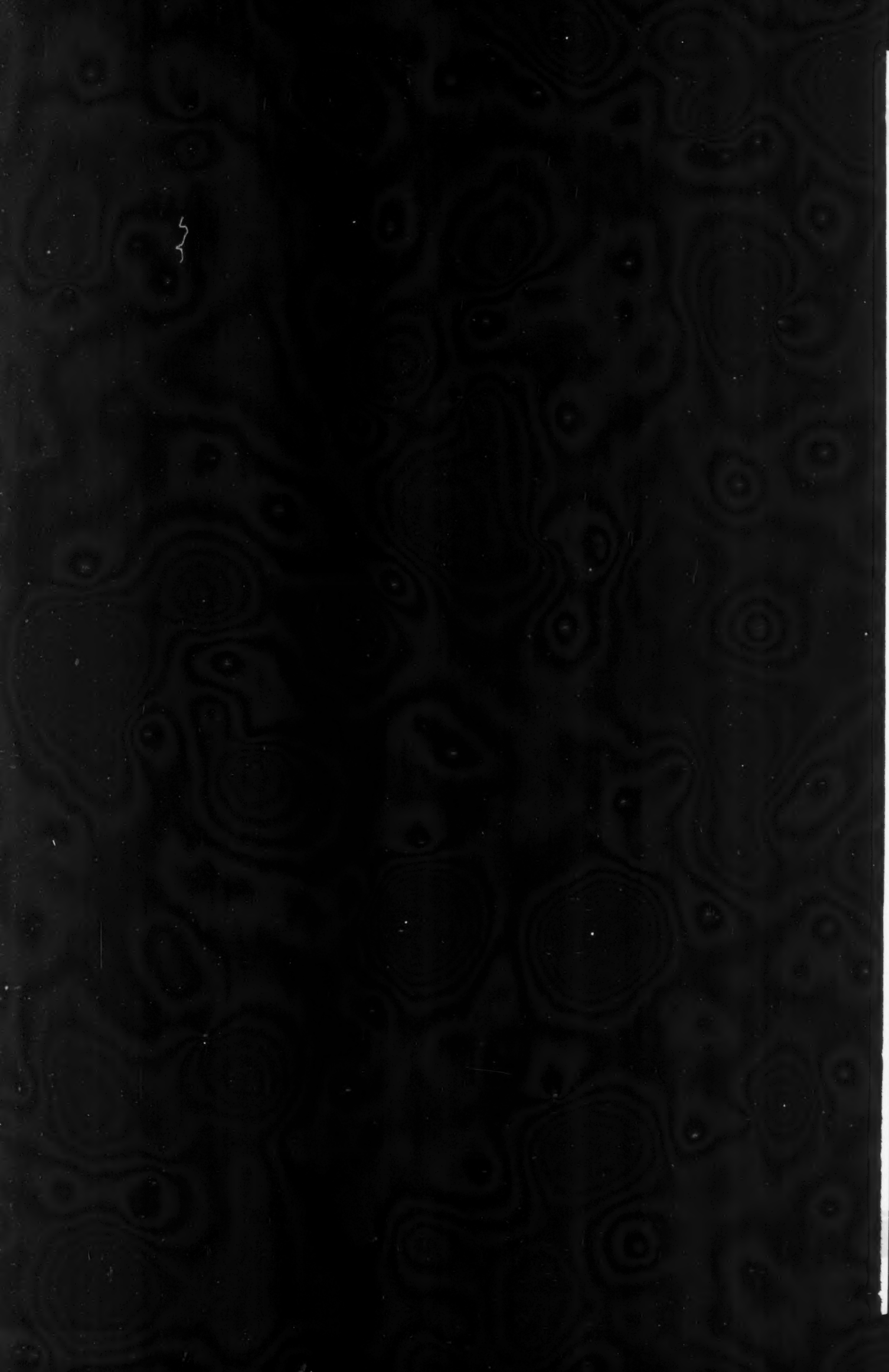


Fig. 2. Progressive Stamping, Piercing, Notching, Forming, and Cut-off Die Employed in Making Rail Ties for Miniature Train Tracks



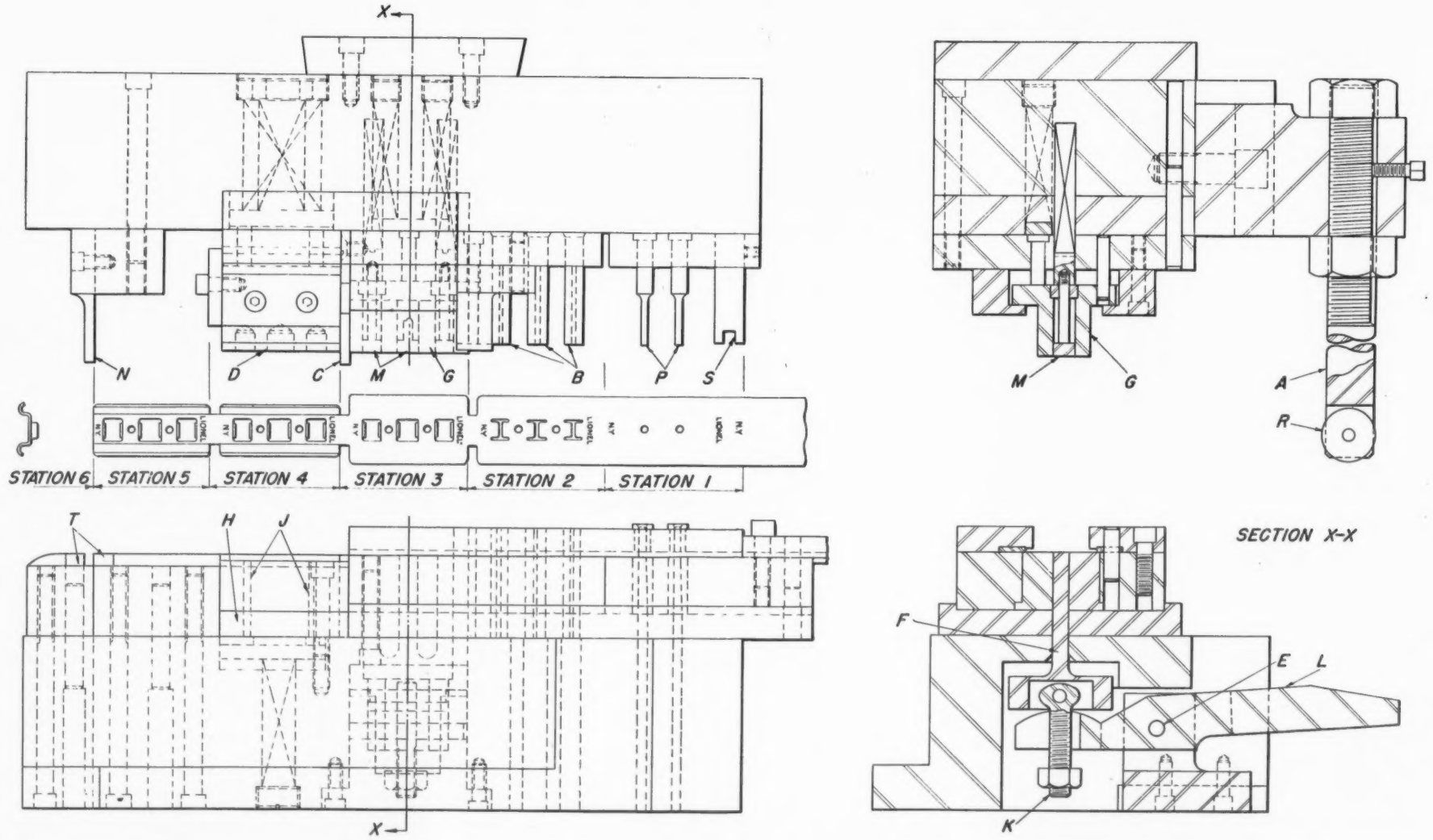


Fig. 3. Details of the Progressive Die Illustrated in Fig. 2. A Piece of Strip Stock is Shown between the Punch and the Die to Indicate the Operations Performed at Each Station

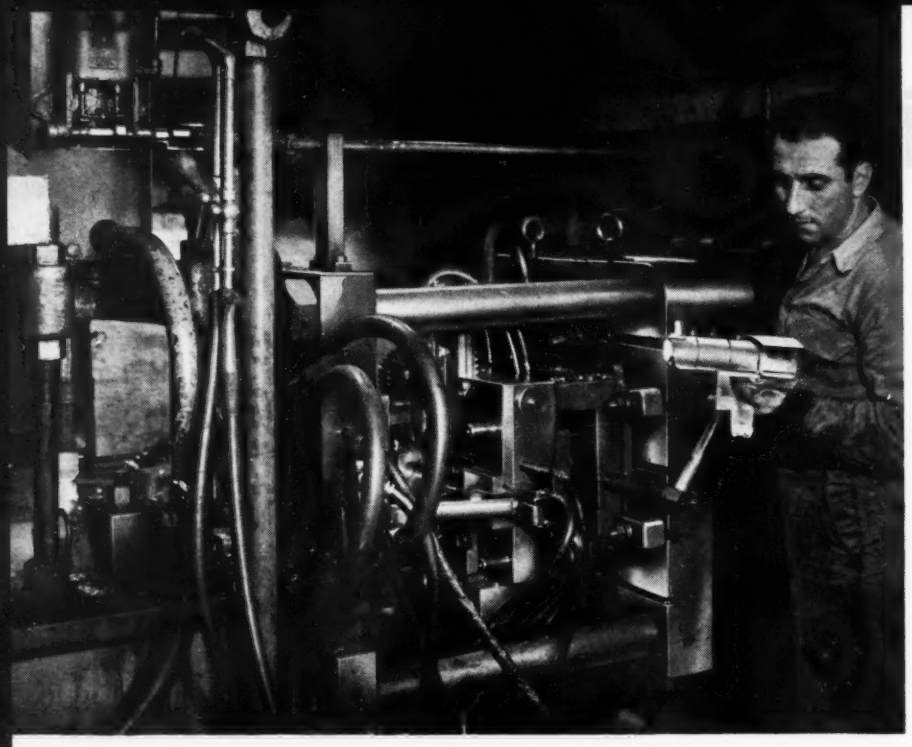


Fig. 4. Scale-model Locomotive Bodies are Obtained by Die-casting Zinc Alloy under an Injection Pressure of 60,000 Pounds

strip is notched at its left end. The next operation, performed at the third station, consists of bending up the lugs formed by the I-shaped openings. This is accomplished by an unusual cam arrangement, a detail view of which is shown in section *X–X*.

Referring to the sectional view, roller *R*, pinned to the lower end of adjustable arm *A*, comes in contact with cam-lever *L* as the ram of the press descends. The cam-lever pivots on pin *E*, and the cam surface on the left-hand end of the lever raises a three-pronged forming punch *F* which bends the lugs on the strip stock upward. The strip stock is kept flat during the forming operation by shedder *G*. Three spring-loaded pins *M* recede upward as the lugs are bent. On the up stroke of the ram, these pins eject the strip from the die.

Directly below the right-hand end of cam-lever *L*, on the bed of the press, is a rubber bumper (not shown). This bumper, which is compressed by the lever on the down stroke of the ram, returns the lever to its original position on the up stroke. In returning, the lever pulls forming punch *F* down to its starting position by means of adjustable latch *K*, which is pinned to the punch.

At the fourth station, a horseshoe-shaped pilot *C* positions the strip by entering the notches previously cut while runners are formed along the sides of the strip by punch *D*. After the forming operation, spring-operated ejector pins *J* lift the strip from the forming die, so that it is free to be fed on to the next station. An interesting design feature at this station is the use of a tool-steel back-up block *H* below the form-

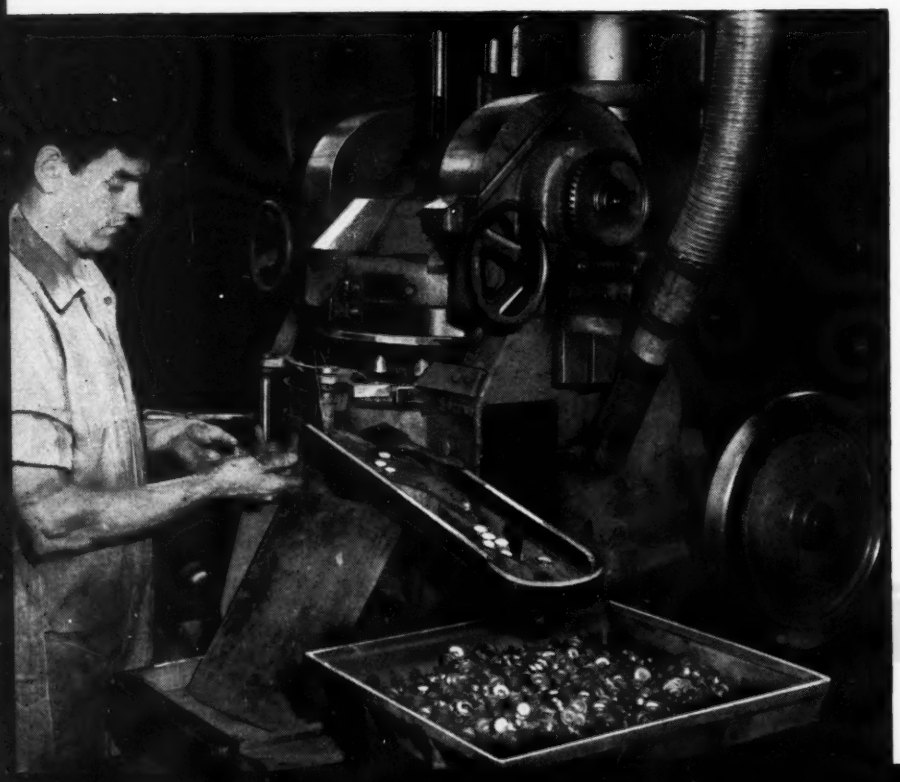


Fig. 5. Multi-station Rotary Press which Forms the Locomotive Wheels from Powdered Iron at the Rate of 308 per Minute

ing die. When the face of the complete die is reground—which is necessary after producing about one and a quarter million ties—this block and the forming die are removed. This eliminates unnecessary grinding of the forming die, which does not wear as rapidly as the other die members. After the grinding operation, a similar amount of stock is removed from the block to insure the proper alignment of the die when it is replaced.

The fifth station is idle. This location was formerly used for cutting off each tie from the strip stock, but it was found that this interfered with successful forming at the preceding station. Now the ties are cut off at the sixth, and final, station. Knife blade *N* passes between carbide nibs *T*. The cut-off tie falls into a tray at the left-hand end of the die.

Locomotive frames are die-cast from a zinc alloy containing about 4 per cent aluminum, 1 per cent copper, and the remainder zinc. The hydraulic die-casting machine shown in Fig. 4 was especially designed to produce the high pressure required to force the molten metal into the numerous fine cavities of the mold and prevent porosity in the casting. One locomotive frame is produced per "shot," giving a daily production of 1125. The zinc alloy is melted at 800 degrees F. and ladled into the holding pot of the casting machine, where it is automatically maintained at this temperature by thermostatic control of the gas fire.

A 5-inch diameter hydraulic cylinder is employed on this plunger type machine to give an injection pressure of 60,000 pounds. Rings on the plunger are expanded by the pressure of the metal being injected, affording a tight seal and maintaining the pressure during the chilling of the casting. An electrical timing mechanism automatically controls the closing and locking of the die-plates, injection of the metal, cooling cycle, opening of the plates, and ejection of the casting. Flash and sprues of the casting are remelted, so that there is practically no scrap loss.

Wheels for the locomotives are pressed from powdered iron on a standard Stokes nineteen-station rotary type press, as seen in Fig. 5. The powdered iron, compounded with lubricant, is tumbled for thorough mixing before being pressed into the desired shape. Though only fifteen of the nineteen stations on the press are utilized, nearly 150,000 wheels are produced on a single machine in one day.

The mixed powder is placed manually in the hopper at the top of the press and is fed by gravity into the die cavities in the rotary table. A stationary wiper arm, flush with the face of the table, removes the excess powder. Both punch and die are made of solid carbide, brazed into the punch- and die-blocks. Hardened steel pins with chromium-plated tips to minimize wear are mounted in the punches to form the axle holes in the wheels. A small-diameter hole in the punch allows excess powder to escape from the pin cavity during the pressing operation. Two finished size wheel briquettes are produced at each stroke of the press and are ejected from the die cavities by positive-acting pins.

Since the pressed wheel briquettes are quite brittle, they are sintered by passing them through an electrically heated controlled-atmosphere furnace, maintained at 1600 degrees F. During this process, a welding or diffusion of the adjacent metal particles occurs. Such wheels were formerly die-cast or formed from sheet-metal stampings, but powdered-metal wheels have been found to give a more realistic appear-

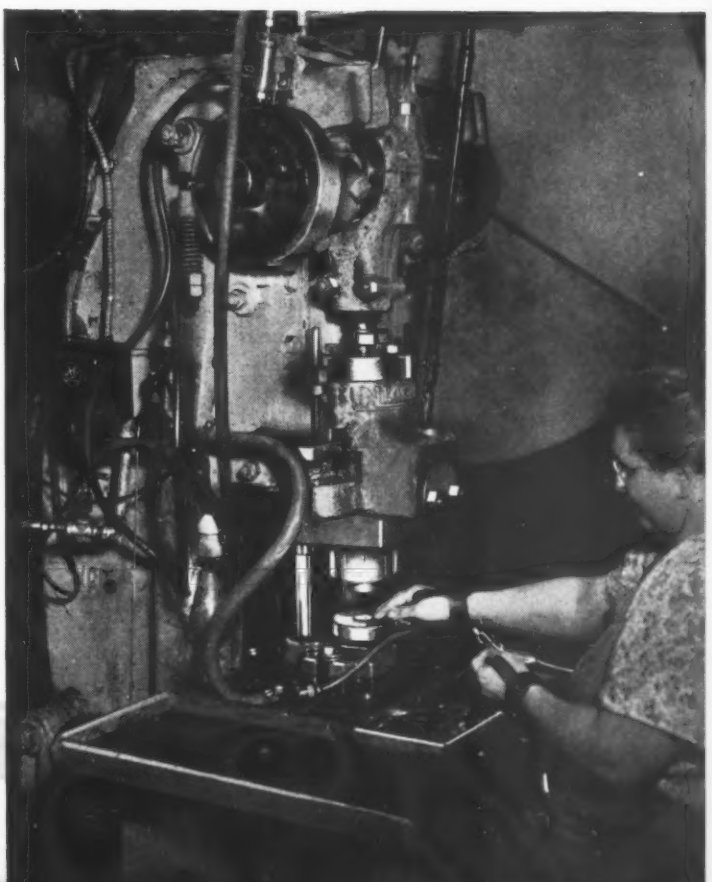


Fig. 6. Carbide Die Set up for Drawing Steel Rings from Flat Blanks at the Rate of 1200 per Hour

ance, are equally serviceable, and can be produced faster and at lower cost, since finishing operations are eliminated.

Flat steel tires, press-fitted on the peripheries of locomotive drivers to produce greater traction, are produced at the rate of 1200 per hour in an unusual operation on a carbide die. From a blanked ring of metal with an outside diameter of 1.460 inches and an inside diameter of 1.135 inches, a tire 3/16 inch wide is produced. While the former method of cutting off the parts from seamless tubing might appear to be simpler

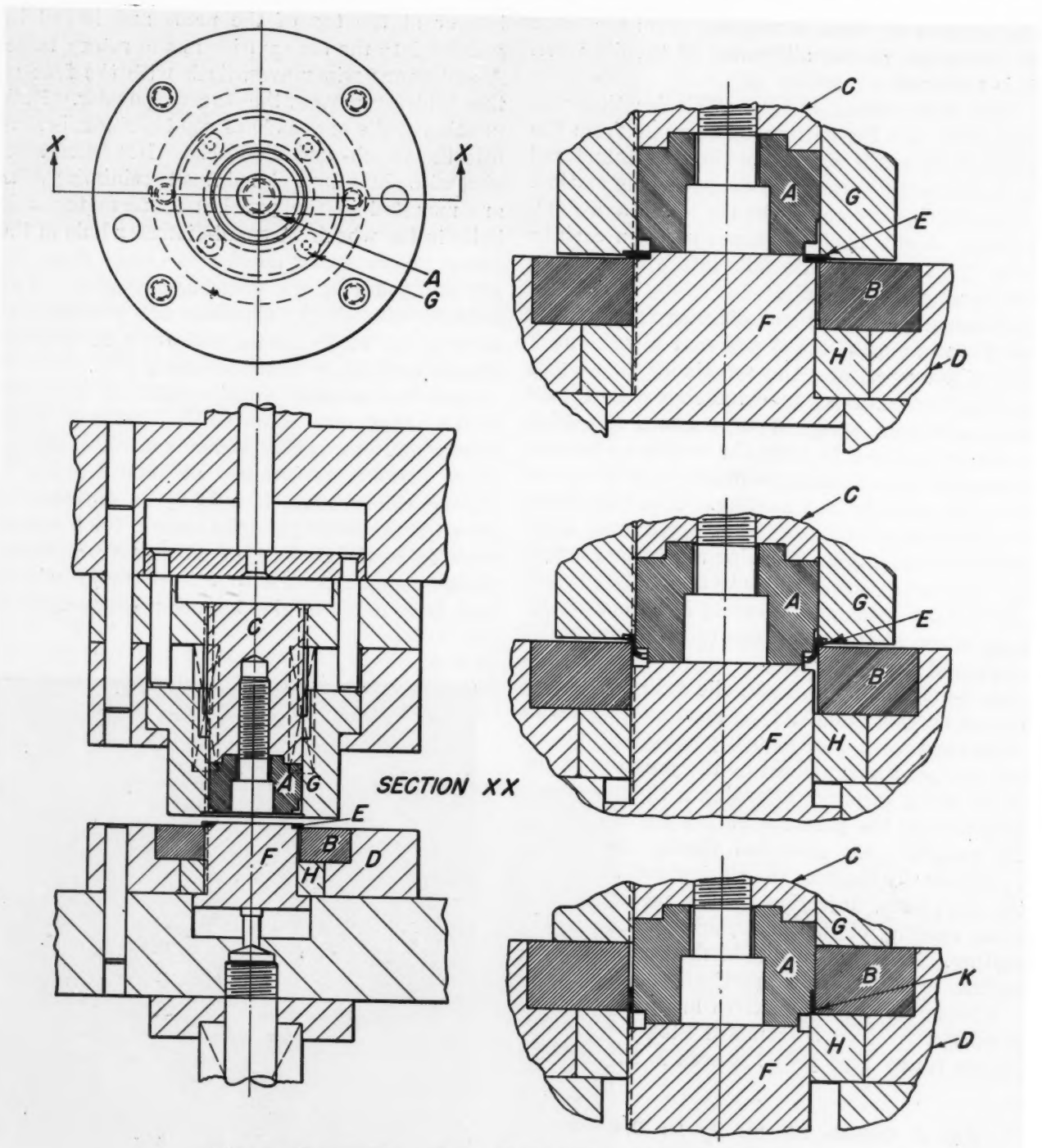


Fig. 7. Cross-section of the Carbide Die Shown in Fig. 6

Fig. 8. Special Roll Forming Machine with Curving Attachment for Making Track Rails from Zinc-plated Cold-rolled Steel Strips

and more economical, a considerable saving has been effected by forming the rings from pierced flat blanks. The carbide die employed for this purpose is seen in operation on a Niagara 25-ton press in Fig. 6, and a cross-sectional view is shown in Fig. 7.

Drawing punch *A* and die *B*, Fig. 7, are made of solid carbide, brazed to the punch- and die-block *C* and *D*, respectively, to resist the wear of this severe cold-working operation. Blank *E* is placed over the locating diameter at the top of the lower shedder *F*. As the ram of the press descends, the upper spring-loaded shedder *G* comes in contact with the blank and holds it, as shown in the view at the top right of the illustration. Punch *A* depresses lower shedder *F*.

As the ram continues downward, the blank is drawn into the annular recess formed between the punch and die, as seen in the center sketch at the right. The outside diameter of punch *A* forms the inside diameter of the finished ring *K*, and the inside diameter of the die *B* forms the outside diameter of the ring. The ring is forced by the shoulder on the punch against bottoming pad *H* to prevent the formation of wrinkles or the thinning out of the ring at its edges.

Lower shedder *F* is provided with three vertical ribs on its periphery, spaced 120 degrees apart, which eject the finished ring from the die nest as the shedder is returned to its original position by spring action. These ribs slide in slots ground in pad *H*.

If the ring sticks to the punch, as occasionally

Fig. 9. Progressive Steps in Forming Flat Strips into Track Rails on the Special Machine Seen in Fig. 8

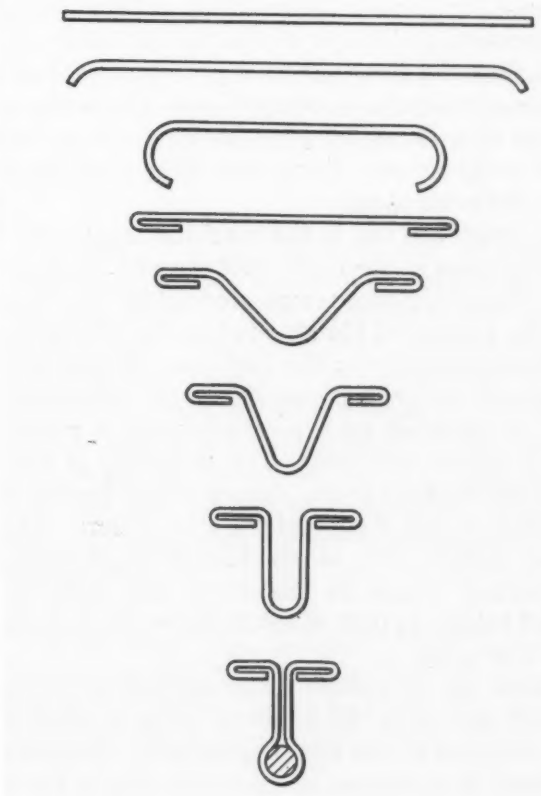


Fig. 10. Rails and Ties for Track Sections of Toy Electric Trains are Assembled on Dial Presses at the Rate of 1250 per Hour

happens, it is automatically ejected by three similar ribs on upper shedder *G*, which slide in slots in punch *A* and punch-block *C*.

Track rails are formed from zinc-plated cold-rolled steel strips, 1 1/8 inches wide by 0.015 inch thick, in various lengths, on the special machine shown in Fig. 8. Tin-plated strip stock was used for these rails previous to the current tin shortage, and faster production could be obtained than the 4000 per hour produced with the zinc-plated material now employed. The machine consists of a series of gear-driven form rollers which progressively shape the strip stock as it passes between them.

The strips are fed to the machine from a vertical magazine at the right (not shown). Suction from a vacuum pump removes one strip at a time from the bottom of the stack of parts. The strip is fed mechanically to the first pair of rollers—one located above and one below the horizontal strip. Thereafter each successive set of rollers feeds it to the next set. The flat strip is progressively changed to the shapes shown from top to bottom in Fig. 9 by eight sets of rollers. The tubular section seen at the bottom is produced by inserting a pin in the stock and applying knurled rollers to both sides of the work directly above the wire.

A ninth set of rollers feeds the rail to a pin assembly section of the machine, where a notched pin is inserted in one end of each rail. The pins are placed in a hopper, as shown in Fig. 8, from which they fall into slots in a rotary magazine. Through a cam action a single pin only is permitted to fall onto each rail. A pair of rollers pushes the pin into the advancing end of a rail and pinches the rail at a point corresponding to the location of the notch in the pin, thus firmly locking the pin to the rail.

In the case of curved tracks, another set of knurled rollers ejects the rail into a special curving attachment located on the left-hand end of the machine. This attachment consists of a series of small-diameter gear-driven rollers, each roller having the shape of the rail cross-section ground into its periphery. These rollers and a set of stationary rollers at the end of the attachment are located on a curve to give the desired radius to the track.

Track rails and ties are assembled at the rate of 1250 per hour on dial presses, such as the Bliss press shown in Fig. 10. Here, five operators place sub-assemblies in nests on the face of the rotating, twelve-station dial. When each station reaches the operating position under the dies, all components of the track section, including fiber insulation between the "third" or center rail and the tie, are in their proper place. The dies on the press ram stake the ties to the rails by pinching the raised lugs over the rails. One track section is completed at each stroke of the press, the finished part being automatically ejected by a blast of compressed air. An inspector seated at the right of the press tests each track section for strength, appearance, and electrical conductivity.

Do the Actual Workers Really Approve Taft-Hartley Law?

RARELY, if ever, has a law received as much abuse as has been directed by the labor unions against the new labor-management relations act known as the Taft-Hartley Law. Why? Is it because the individual members of unions are unaware of the exact provisions of this law?

In a recent number of "Look," Claude Robinson, president of the Opinion Research Corporation, summarized the results of an extensive poll conducted to determine how union workers themselves felt about the provisions of the Taft-Hartley Law. Corps of interviewers sent into the concentrated manufacturing areas in the East and Middle West asked a large number of union members whether, if they were members of Congress, they would vote for or against the following laws:

1. A law to require unions to give sixty days' notice before they can go out on strike.
2. A law to give the company the right to sue the union if the union breaks its contract.
3. A law to allow employers to talk to the workers on the subject of joining unions, as long as they don't threaten the workers or promise rewards for not joining.
4. A law to require unions to make reports on the money they take in and what they spend it for.
5. A law to prevent Communists from holding offices in unions.
6. A law to prohibit unions from spending money or making contributions in connection with political campaigns for federal offices.
7. A law to allow the check-off only if the worker agrees in writing
8. A law to forbid a company to have a union shop until a majority of all the workers vote in favor of it.
9. A law to outlaw the closed shop.
10. A law that, in industries considered vital to the country's welfare, would allow the Government to get a court order preventing a strike for several months while settlements were being attempted.

In nearly all cases, the vote was predominantly in favor of the proposed law. As regards law No. 4, for example, which would require unions to make reports on the money they take in and what they spend it for, 85 per cent of the union members polled were in favor of such a law, and only 12 per cent against, 3 per cent expressing no opinion.

For law No. 2, which would give the company the right to sue the union if the union broke its contract, the vote was 70 per cent in favor of the law and only 20 per cent against, while 10 per cent expressed no opinion. The closest vote was for law No. 9 which would outlaw the closed shop. In this case, union members voted 48 per cent in favor of the law and 43 per cent against, while 9 per cent registered no opinion.

It is noteworthy that each one of these "suggested laws," for which a majority of the men polled voted, is already the law of the land. Together they comprise the Taft-Hartley Law. When the poll was taken, the union members were not aware of this fact. A vote taken as to whether they were in favor of the Taft-Hartley Law showed 64 per cent against, 25 per cent in favor, and 11 per cent expressing no opinion.

What does this indicate—that an aggressive publicity campaign has given an undeservedly bad name to a law that most of the workers themselves really want?

Charles O. Herb

Electronic Motor Drives Increase

Such Characteristics as Wide Stepless Speed Control, Uniform Speed under All Operating Conditions, Constant-Torque Acceleration, and Adaptability to Automatic Operation Make Electronic Motor Drives Suitable for a Variety of Applications where Exacting Performance is Required

THE electronic motor drive has many operating characteristics that make it a valuable addition to the available types of adjustable-speed drives. This is especially true in the operation of automatic machines, for which it has been widely applied. The application of this type of drive to machine tools and similar types of equipment has, in many cases, increased their output and operating scope and made possible more simplified machine design.

The majority of electronic motor drives consist of four units—a motor, a control panel, an anode transformer, and a small unit control station that provides complete control of all operations. Included in these controls is a current limiting circuit that limits the maximum motor armature current to any desired value between 100 and 200 per cent of the full-load current. As the torque of a shunt-wound direct-current motor with constant field excitation is almost directly proportional to the armature current, the maximum motor torque is determined by the current-limit setting.

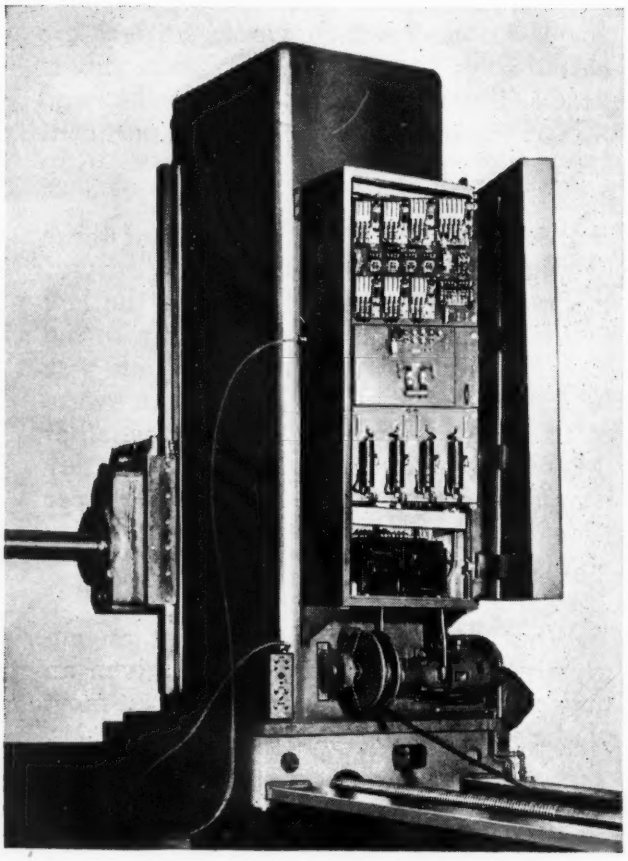


Fig. 1. Application of Electronic Motor Drive to Feed Motion of Horizontal Boring Machine

This current-limit feature has the following advantages in machine applications:

1. Heavy loads are accelerated to operating speeds in a minimum of time.
2. The motor torque rises to a preset maximum value and is maintained at this value during acceleration.
3. In machines subject to stalling, the maximum torque is limited to a safe value.

Constant-torque speed ratios in excess of 50 to 1 are also obtainable with an electronic motor drive. A wide speed range is obtained by rectifying alternating current into controlled direct current, which is used to drive the motor. An example of a drive having a wide constant-torque speed range is shown in Fig. 1. The electronic control used to drive the boring machine feed motor is adjusted by a small potentiometer like that shown in Fig. 2.

An added feature of this machine is a magnetic control that regulates other driving motors; it is located at the top of the control cabinet. The combination of an electronic motor drive with magnetic control is very common. With this combination, the electronic control is used to supply the desired motor characteristics, while the magnetic control is employed to provide a sequence of operations or to control other equipment on the machine.

Constant horsepower instead of constant torque can be designed into the drive if desired. However, as the constant-horsepower speed range of any adjustable-speed motor drive is increased, the size of both the motor and the control of the drive also increase. Hence the cost of a constant-horsepower drive designed to operate over a wide speed range may be prohibitive for some applications. A drive having a constant-horsepower characteristic over a por-

Machine Tool Versatility

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tion of the speed range and a constant-torque characteristic over the remainder has fulfilled many drive requirements; in almost all applications of this nature, the constant-horsepower speed range is relatively small.

Uniform Operating Speeds under All Conditions

The standard electronic motor drive is able to considerably reduce variations in speed resulting from changes in load and voltage. This drive is designed to keep the motor speed (at normal operating temperature) within 2 to 5 per cent of the rated speed from full load to no load over a line voltage variation up to plus or minus 10 per cent. However, the motor speed may vary as much as 15 per cent due to motor heating and changes in ambient temperature.

For applications in which a gradual variation in speed caused by motor heating and ambient temperature changes is not objectionable, a standard drive is suitable; however, for applications requiring the speed to be kept constant over a long time period, it is unsatisfactory. In the latter case, an electronic drive slightly different from the standard type can be used.

This drive is designed to maintain motor speed within 1/2 of 1 per cent of full speed from full load to no load over a line voltage variation of plus or minus 10 per cent and over any normal variation in motor temperature or ambient temperature. Such a drive requires the addition of a tachometer generator to the motor and the use of an electronic panel slightly different from the standard panel.

An interesting example of the ability of a drive of this type to maintain a constant speed is its application on an automobile vibration testing stand. In this application, the automobile to be tested is mounted on off-center driving wheels on the stand. The wheels are then rotated, and because they are offset, produce a vibrating motion in the automobile. The speed of the driving wheels is increased until the resonant frequency of the automobile is attained. The load of this drive increases slowly until the point of resonance is reached and then increases rapidly.

Prior to the use of an electronic motor drive on this application, it was extremely difficult to keep the stand operating at resonant frequency, and continual manipulation of the control was required. An electronic motor drive designed to hold the speed within one-half of 1 per cent was then applied and proved very successful. The operation now consists of placing the automobile on the offset driving wheels, pressing the start button, and then slowly bringing the speed up to resonance by means of the small speed potentiometer. Once the resonant speed has been reached, the electronic motor drive will maintain this speed indefinitely.

Fig. 2. Unit Control Station Used with Standard Electronic Drive Provides Centralized Operation of All Functions, Including Speed Adjustment

Electronic Drive Widely Used to Obtain Automatic Operation

It is in the field of automatic machine operation that the electronic motor drive has shown its greatest adaptability. The nature of the electronic drive is such that the speed of the drive motor may be made to follow any function which can be made to produce a voltage that varies in proportion to the change in the function.

Thus, by modification of pressure and temperature meters, electronic drives have been made to follow fluctuations in temperature and pressure. The intensity of a light beam measured by a photo-electric tube and converted into a voltage signal has been used to adjust the speed of an electronic motor drive. A tachometer

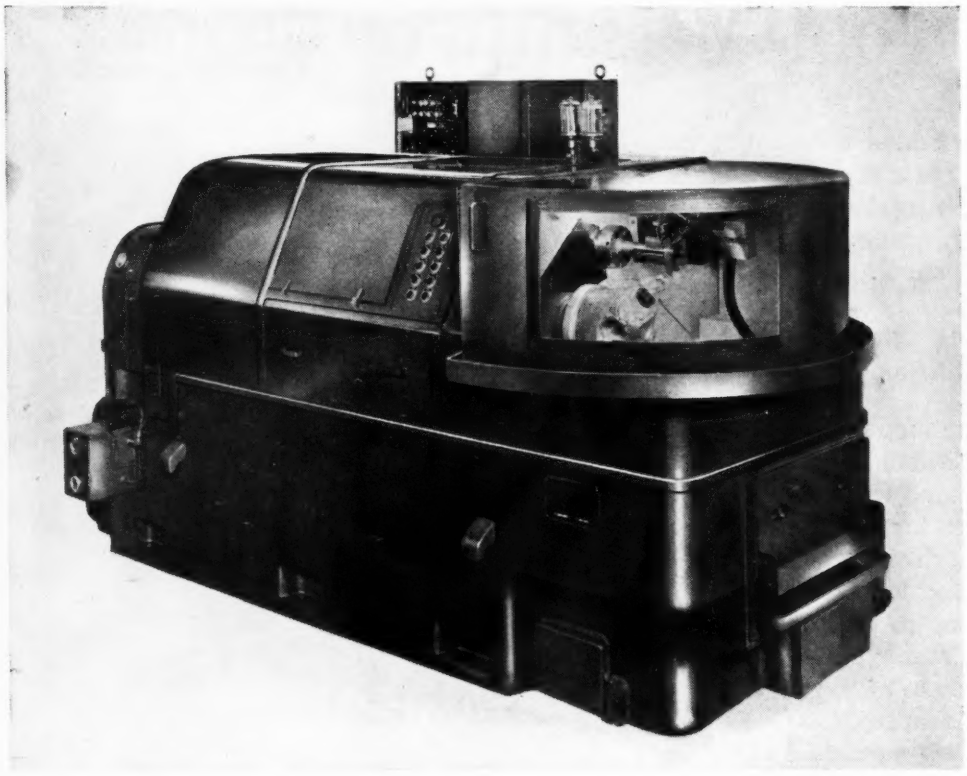


Fig. 3. Sundstrand Fin Milling Machine Equipped with Electronic Feed Drive to Automatically Hold Full Load on the Spindle Motor. Production was Increased by 35 Per Cent with This Drive

generator attached to a revolving shaft will produce a voltage signal that the electronic drive will follow faithfully, changing its speed with each change in the speed of the lead machine.

One interesting example of the use of an electronic motor drive is for the automatic operation of a milling machine used to cut the radiating fins on aircraft engine cylinders. The designer of the machine desired to keep full load on the spindle motor, regardless of the depth of cut. This method of operation would give considerable advantage over the use of a constant-speed motor drive where the feed mechanism would have to be adjusted to give full load on the spindle motor at the point of maximum cut. This meant that the spindle motor would be only partially loaded during much of the operation.

The electronic-drive motor was used to supply the power for the feed and a current transformer was placed in one line of the spindle motor. The

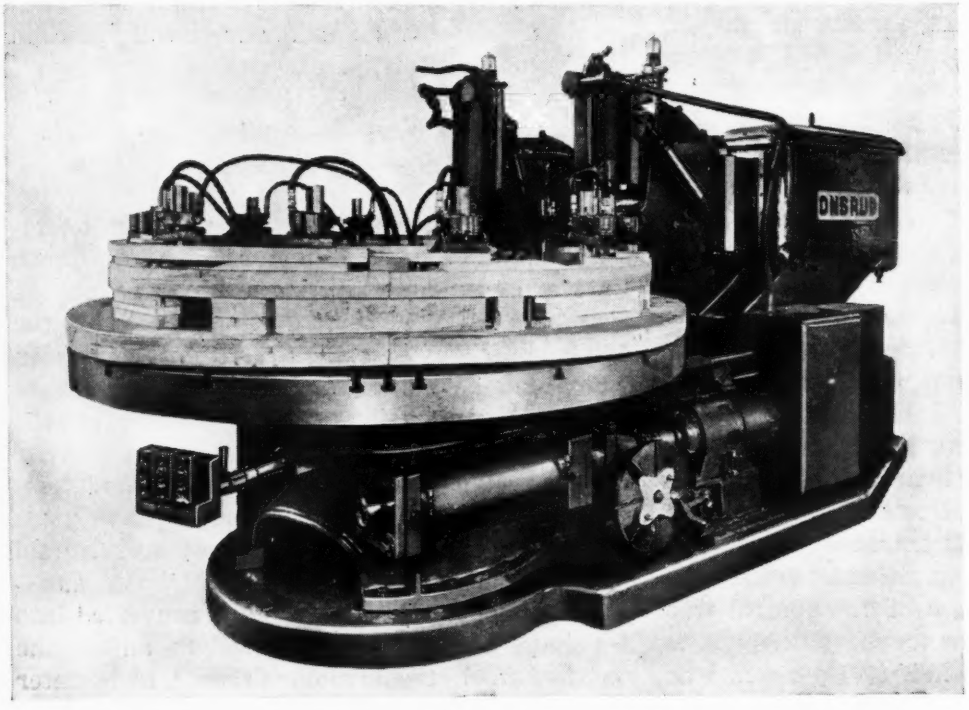


Fig. 4. Automatic Shaper with Electronic Motor Drive. A Follower Mechanism Traces the Outline of a Model and Changes the Rotating Speed of the Table so that Constant Peripheral Speed of the Irregular-shaped Workpiece is Obtained

current transformer produced a voltage signal which was directly proportional to the load on the spindle motor. This signal was used to control the speed of the feed motor, so that the load on the spindle motor was maintained at full-load value.

Tests taken on this machine show that its production was increased 35 per cent. Fig. 3 shows this application, with a portion of the electronic motor drive appearing above the back of the machine.

The automatic shaper shown in Fig. 4 is another machine employing the electronic motor drive. This machine is used to cut irregular shapes in a piece, and its operation is greatly improved if the peripheral speed of the work as it passes the cutting blade is maintained constant. To accomplish this end, the machine was designed with a small turntable mounted on the side of the machine and mechanically connected to a large turntable. A small model of the piece to be cut was mounted on the small turntable and a follower wheel was linked to the speed potentiometer of the electronic motor drive. This wheel follows the contours of the model and automatically changes the speed of the large turntable, on which the work is mounted, to maintain a constant peripheral speed of the work.

Almost all electronic motor drives include a preset speed feature. Several preset speeds are obtainable through a small push-button station containing the preset speed potentiometers and a transfer switch for changing from one preset speed to another. Another commonly used drive for applications requiring that the preset speeds be held accurately consists of an electronic motor drive designed to hold speed within one-half of 1 per cent, a small control station containing the preset speed potentiometers, and the transfer switch. Such equipment will hold the motor speeds within the limits mentioned, regardless of changes in temperature, load, and voltage.

One such drive is now used in tachometer testing equipment, as shown in Fig. 5. The requirements specify that the tachometers be tested for accuracy over a speed range of 200 to 4000 R.P.M. by comparing the tachometer indicators with a master stroboscopic disk.

The tachometer is put in the testing machine and the transfer switch advanced to each of the preset testing speeds as fast as the accuracy of the unit can be checked. There is no need to readjust the preset speeds frequently, as the electronic motor drive will hold each speed accurate as long as the testing stand is in operation.

Fig. 5. Tachometer Testing Stand Providing Several Preset Speeds. Electronic Motor Control is Mounted in Case

* * *

Over a Billion Dollars Worth of Supplies Bought by Railroads Last Year

The railroads are one of the most important customers of the basic industries of the country. In normal years, they purchase about 23 per cent of the bituminous coal production, 19 per cent of the fuel oil output, 16 per cent of the timber cut, and 17 per cent of the iron and steel output. A total of $1,570,555,000 was spent by the Class I railways in 1946 for materials and supplies. Of this total, purchases of fuel aggregated $553,153,000; forest products, $148,984,000; iron and steel products, $520,546,000; and miscellaneous supplies, $347,872,000.

Gear Manufacturers' Meeting Devoted Chiefly to Standards

THE semi-annual meeting of the American Gear Manufacturers Association, held at the Edgewater Beach Hotel, Chicago, Ill., late in October, was characterized as usual by the painstaking attention given by the committees to standards pertaining to the gearing industry. In addition, two comprehensive technical papers were read, both of which were followed by discussions.

Raymond B. Tripp, President of the American Gear Manufacturers Association

The meeting was opened by Raymond B. Tripp, president of the Association. Mr. Tripp dealt briefly with the problems and activities of the gearing industry and of the association, and touched upon the subject of certain government restrictions and labor conditions. After the reports of the administrative committees had been read, most of the time was devoted to consideration of standardization by the various committees, including those on enclosed gearing, open gearing, splines, nomenclature, high-speed gearing, automotive gears, inspection, fine-pitch gearing, gear-cutting tools, spur gearing, bevel gearing, worm-gearing, lubrication, materials, and trade practices.

Papers Read before the Meeting

At one of the general sessions of the meeting, F. E. Birtch, manager of the Cone-Drive Division of the Michigan Tool Co., Detroit, Mich., read a paper entitled "Cone-Drive." This was a comprehensive review of the development and design of cone-drive gearing, giving details relating to pressure angle, number of teeth, circular pitch, and tooth thickness of gears and pinions; in addition, such subjects as proportions of gear and pinion materials, lubrication, tolerances, and relief were dealt with. The illustrations gave a clear idea of the cone-drive elements and cone-drive lay-outs.

A typical lead checker for cone-drive pinions was illustrated and described, as well as the standard ground form of cone-drive hobs and generating cutters. The procedure in rough- and finish-hobbing, as well as in rough- and finish-generating, was described. The subject of contact and contact lines in cone-drives was also covered comprehensively. The address concluded with a summary of the advantages of cone-drive gearing.

At another session, L. J. Collins, of the General Electric Co., presented an address entitled "Gears—Their Application, Design, and Manufacture." In his paper, the author divided gearing into two general classes—commercial and general-purpose gearing, and precision gearing. In defining the best gear for a given application, the author said: "The best gear for a given application is the one that will satisfactorily perform all the functions for which it was manufactured for the length of time specified and for the lowest possible cost of manufacture."

Precision gears he defined as gears that are manufactured in accordance with the highest possible degree of accuracy obtainable from precision machine tools that are maintained in accordance with the recommendations of the machine manufacturers.

Factors Determining Classification of Gears

Proceeding, the author enumerated the factors that determine whether gears for a given application should be classified as commercial or general-purpose gears, or precision gears. These factors are space limitations, torque, pitch-line velocity, moment of inertia of connected masses, torque variations of prime mover or of load, number of interconnected gears, stiffness of supporting structure, allowable noise, and length of service required. He briefly outlined each of these factors as related to gear design.

Space limitations, he pointed out, have resulted in great advances in the gearing industry. Small, compact gear units are today transmitting loads that even ten years ago were considered impossible. In order to carry high tooth loads in gear

drives occupying a small space, the gears must either be cut from materials of high hardness or hardened after cutting. Hardening after cutting the teeth generally results in distorting the gears, so that an added operation must be performed to correct the distortion.

As the linear velocity of the gear and pinion pitch circles increases, the importance of accurate tooth spacing becomes greater. When the linear velocity of the pitch circles increases, the sliding velocity also increases, and the surface finish of the teeth becomes more and more important, particularly under heavy loads. This affects the problem of lubrication, and may necessitate refinements of the surface finish of the teeth, even though at the same load, but lower speed, the surface finish would be adequate.

Moments of Inertia of Connected Rotating Masses

In regard to the moments of inertia of the connected masses, it was mentioned that too often the only moments of inertia considered are those of the pinion and the gear. In the majority of installations, these values are small compared to the moments of inertia of the connected masses. There are two conditions that result in high tooth loads which are attributable to the moments of inertia of the connected masses—(a) changes in angular velocity resulting from errors in tooth spacing or concentricity; and (b) rapid changes in angular velocity due either to torque pulsations from the prime mover or load or to the time speed cycle over which the unit must operate.

Errors in tooth spacing or concentricity have a tendency to increase the rotational speed of one element and decrease that of the other. The inertia of the load and prime mover, as well as the inertias of the pinion and gear, oppose these changes. The result of the foregoing is a sudden application of load to the mating tooth surfaces. In some installations, the torque delivered by the prime mover, or absorbed by the load, may vary, as in the case of a Diesel engine, or an air compressor. A high load may be imposed on the pinion and gear during acceleration or deceleration if the speed changes are made in short intervals of time.

On the subject of stiffness of the supporting structure, the author mentioned that the term "supporting structure" in this case refers to the housing, the function of which is to maintain alignment between the gear elements. It is not sufficient to consider the effect of the load on the tooth surfaces only. The unit loading is of no significance unless the pinion and gear are maintained in the proper relationship to each other. In some applications, it is important to design flexibility into the supporting structure. When this is the case, the design should be such that the resulting deflections do not alter the relative positions of the gear elements.

Allowable Noise in Gearing

No one item concerning gears has received more comment than noise. This may be explained as follows: Power is transmitted from pinion to gear or from gear to pinion through the tooth contacts. Since the teeth are machined in solid material, noise is generally believed to be caused by the impact of one tooth upon another. This gives rise to the feeling that damage is being done to the tooth surfaces when noise is heard.

Noise readings and sound analysis have been made on objectionable gears where the tooth mesh frequency component was so low as to be undetectable. In many instances, the major difficulty was found to be attributable to one or more of the following: (a) misalignment of rotating parts; (b) eccentricity of pinion or gear; (c) unbalance of rotating parts; (d) resonance of one or more parts of casing or rotor; (e) beat notes between various components; (f) critical speed vibrations, or oil whip; and (g) oil trapping in the tooth spaces.

It is extremely difficult to evaluate the allowable noise level of a gear unit. However, a complaint is almost certain to be registered if the gear noise can be heard above the noise level of the apparatus connected to the gear unit or operating near it.

Gears used in conjunction with military equipment may emit sounds that are easily detectable, resulting in a military hazard. In the design of this type of apparatus, exhaustive studies and tests must be made.

Length of Service Required

Where light-weight machinery is required, it may be economical to replace an entire gear unit, or parts thereof, at prescribed intervals. In such a case, the designer is asked to produce a set of gears that will not fail for a definite period of time. The point at which a gear fails may vary for different applications, and therefore should be specified at the time of original design.

For example, it is obvious that all gears are considered to have failed when the teeth break off. On the other hand, a gun-fire control gear fails to perform the service for which it is designed when the backlash has increased from 0.001 to 0.002 inch. On a hardened gear, pitting

may be an indication that failure is about to take place and that the gears must be replaced. However, soft gears may start to pit after a few hours of operation, even at reduced loads; but with the passage of time, these gears may be found to have polished teeth, and many years later they may have a better appearance than when originally installed.

Precision Required for Different Services

Relating to the precision required for gearing of different types, the author said: "It sounds well to state that a set of gears is made to the same degree of precision as the gears in an expensive watch. However, there is no need for extreme accuracy in the gears of a watch, even though a good watch registers time accurately for years. All that is necessary is that the gear ratios be correct; but since the gears move very slowly, a high degree of accuracy in tooth form, for example, is not necessary. On the other hand, the huge gears used in an electric locomotive must be exceptionally accurate.

In arriving at a decision as to the type and kind of accuracy required for a given application, the designer must rely upon past experience. When such experience is lacking, the gears must be made and subjected to long and costly tests in order to accumulate the necessary data.

The successful operation of a large and complicated machine often depends upon a single gear and pinion; for example, the lubrication pump and governor on a large 100,000-kilowatt turbine generator may be driven by a simple worm and worm-wheel combination. Were this to fail, it would mean failure of the entire installation.

The author concluded his paper by outlining the degree of precision required in the following types of gears: Gears for clocks, watches, and meters; locomotive gearing; turbine-generator gearing; marine propulsion gearing; accessory gearing; and gears used for machine tools.

At the Association dinner, G. Edward Pendray addressed the members and their guests on a subject of the greatest importance to all industry. He emphasized the necessity of creating better relations between employers and employes by taking the employes into the confidence of the firm. This can be done by furnishing them such information relating to the operation, activities, and policies of the firm as would give each employe a better understanding of the importance of his own work and make him feel that he is considered a real part of the organization. In his address, Mr. Pendray pointed out that the secrecy with which management has often handled its affairs has been the cause of many misunderstandings between management and employes, and much labor unrest could have been avoided by giving due consideration to this subject.

* * *

Norton Co. Shows New Grinders and Sub-Contracting Facilities

As a follow-up to the National Machine Tool Show, the Norton Co. recently held an exhibit at its Worcester, Mass., plant to acquaint dealers, customers, and employes with the design features and operating characteristics of the company's new grinding machines, and to demonstrate to users the possibility of rebuilding obsolete models to meet present-day production demands. Another purpose of the exhibit was to show industries in the New England area the type of sub-contracting work that the plant is capable of producing.

The new machines, including cylindrical, universal, surface, and camshaft grinding machines, tool grinders, and lapping machines, were in actual operation, as were several rebuilt grinders. In the shop, two machines were being rebuilt to grind four-cylinder engine crankshafts for one of the automobile manufacturers. One of the machines was being equipped to grind the two outer bearings, and the other the two inner bearings. Toward this end, two new work-heads and the necessary locating devices and hydraulic clamping fixtures were being added to each, and the units were being completely rebuilt to insure accuracy and continuity of operation.

Other machines and equipment now being manufactured by the concern were also shown. Such devices as paper-box folding machines, lens grinding machines, speed reducers for paper mill drives, and large gear guards for sugar mills are being made for other manufacturers.

* * *

The General Motors Corporation recently announced that 174,854 men and women in the employ of the company had written letters telling why they like their jobs. Thousands of the writers also made suggestions concerning their jobs. These letters were written as part of an employe contest "My Job and Why I Like It." Over 5000 prizes will go to the winners. They include a Cadillac convertible as a grand prize, three Buicks, six Oldsmobiles, ten Pontiacs, and twenty Chevrolets, as well as sixty-five refrigerators, sixty-five electric ranges, fifty automatic washers, fifty electric ironers, and twenty-five home freezers.

Convention of the National Tool and Die Manufacturers Association

THE National Tool and Die Manufacturers Association held its second national membership convention on November 2 to 5, inclusive, at the Benjamin Franklin Hotel in Philadelphia, with over two hundred contract tool and die shop executives from all parts of the country in attendance. A varied program of speeches and technical sessions featured the meeting.

One of the highlights was a report on "Industry's Future in an Explosive World," written by Marshall M. Smith, president of the E. W. Bliss Co., Detroit, Mich., on the basis of observations made during a recent two months' industrial tour of Great Britain, France, and Belgium. As Mr. Smith was unable to deliver his address in person because of illness, it was presented by Ray H. Sullivan, vice-president in charge of manufacture of the E. W. Bliss Co. Another feature of the program was a panel discussion on the subject "Getting Best Results in Tooling," which was participated in by two purchasers of tooling and two shop owners.

Richard F. Moore, president of the Moore Special Tool Co., Inc., Bridgeport, Conn., read a paper entitled "Realistic Methods of Estimating," and Eugene B. Schwartz of Stanley & Smoyer, Cleveland labor relations attorneys, presented a report on "What the Taft-Hartley Act Means to You." William F. Patterson, director of the U. S. Apprentice Training Service, spoke on "Training Toolmakers." He praised the efforts of the Association in helping to alleviate the shortage of skilled toolmakers and diemakers by its apprenticeship training programs.

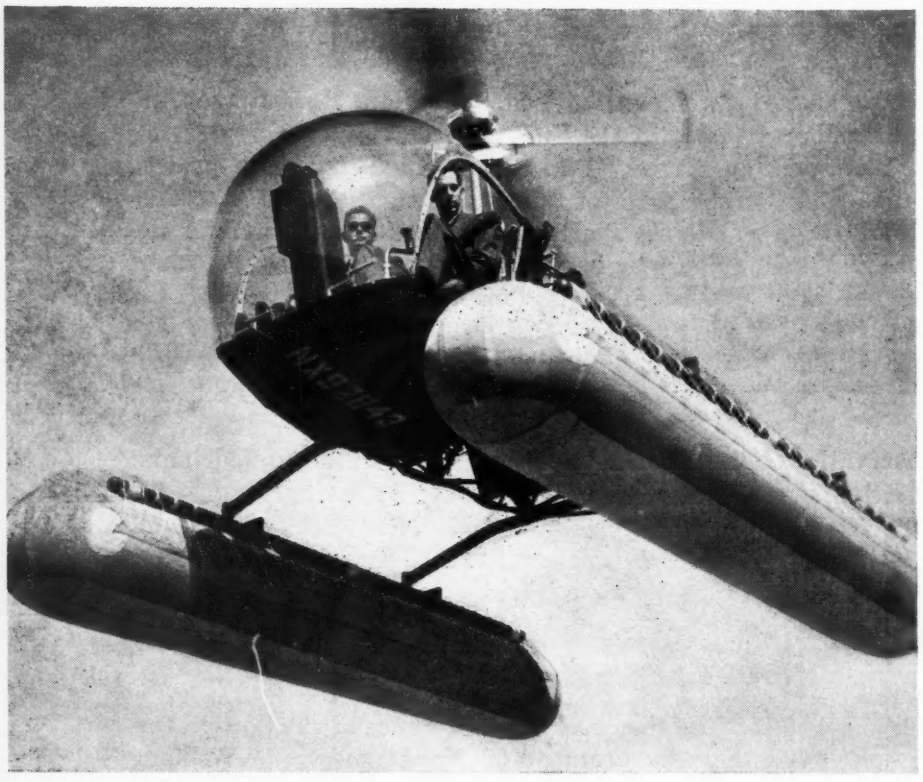
The following officers were elected for the year 1947-1948: President, William R. White, Jr., Midwestern Tool Co., Chicago, Ill.; first vice-president, J. J. Kohl, International Tool Co., Dayton, Ohio; second vice-president, John H. Benetz, Bridge Tool & Die Works, Philadelphia, Pa.; secretary, Centre W. Holmberg, August W. Holmberg & Co., Inc., New York City; and treasurer, Jerome Stanek, Stanek Tool & Mfg. Co., Milwaukee, Wis.

* * *

The theme of the conference of the Society for the Advancement of Management, 84 William St., New York 7, N. Y., to be held in New York City December 2 and 3 at the Hotel New Yorker, will be "The Human Factor in Production." Among the subjects to be discussed are individual productivity; human nature; management-labor relations; and the relationship of human welfare to production, distribution, and finance.

Officers of the National Tool and Die Manufacturers Association Elected for the Year 1947-1948. (Left to Right), Centre W. Holmberg, Secretary; Jerome Stanek, Treasurer; William R. White, Jr., President; John H. Benetz, Second Vice-president; and J. J. Kohl, First Vice-president

Operations in the Production of



Nitriding of Gears to a Case Depth of 0.022 Inch and Bonding of Stainless Steel to Birch Veneer Strips by "Cycle Welding" are Two Noteworthy Operations Employed by Bell Aircraft Corporation in Manufacturing the "Modern Magic Carpet"

By
EDWARD L. KRAMER
Senior Engineer
Bell Aircraft Corporation
Niagara Falls, N. Y.

VERSATILITY, safety, and the ability to fly in practically any kind of weather are reasons why the helicopter—the "Modern Magic Carpet"—is being used extensively in so many varied fields of application. Present uses of the ever-expanding field for these rotary-wing aircraft, which can stop and hover in mid-air, go sidewise, backwards, or straight up or down, include crop dusting, seeding, rounding-up cattle, forest patrol, surveys, fish and game culture, emergency rescues, transportation—especially to isolated areas—fishing fleet operation, prospecting, sports, air mail, and store deliveries. Helicopters can easily be equipped with floats, as shown in the heading illustration, which permit them to descend on water, as well as on the ground.

A few of the many features of these aircraft include a patented two-bladed rotor system with automatic, gyroscopic stabilizing bar and anti-torque propeller; and a large transparent panel in the nose of the plane which provides excellent visibility. Some of the methods employed by the Bell Aircraft Corporation in producing helicopters will be described in the following.

The fabric-covered frames are made of gas-welded, S A E 4130 chromium-molybdenum steel tubing in diameters from 1/2 inch to 1 1/8 inches, and in wall thicknesses from 0.035 to 0.083 inch. The tube ends are shaped on a nibbling machine prior to welding to insure proper mating of adjacent tubes. This nibbling operation, accomplished by placing a master tube having the desired contour over the tube end while it is being nibbled, eliminates the time required for fitting the tubes together by hand-filing.

A tubular engine mount is shown being welded in Fig. 1. Reversible table fixtures, or welding positioners, are used for all operations. Such fixtures produce better results by permitting the operator always to weld downward.

A mixture of two volumes of acetylene, at 7 1/2 pounds per square inch, to three volumes of oxygen, at 11 pounds per square inch, is fed to the hand-welding torches. The welded assemblies are then normalized to relieve any stresses set up in welding. This is followed by sand-blasting, after which two holes, 1/16 inch in diameter, are drilled in each tube. Hot linseed oil is sprayed in these holes to minimize corrosion. After the excess linseed oil has been drained from the tubes, the holes are plugged with tight-fitting screws. Paint is then sprayed on the assembly.

Case depths varying from 0.018 to 0.022 inch are specified for certain of the gears used in the helicopter transmission. Such case depths are obtained by a carefully controlled, special nitrid-

Helicopters at the Bell Aircraft Plant

ing process. Nitralloy gear-blank forgings treated by this process contain from 1.40 to 1.80 per cent chromium, 0.85 to 1.20 per cent aluminum, 0.40 to 0.70 per cent manganese, 0.38 to 0.45 per cent carbon, 0.30 to 0.45 per cent molybdenum, 0.20 to 0.40 per cent silicon, and the remainder iron.

The gear blanks are stacked on a rack with separators between them to permit the best circulation of the nitriding gas. The racks, separators, and furnace retorts are made from nickel, which has no affinity for nitrogen. Steel, if used for such parts, would become embrittled and accelerate the dissociation of the ammonia gas used, thereby preventing proper nitriding of the gears.

The loaded racks are lowered into a Lindberg "Cyclone" 52-kilowatt furnace, as shown in Fig. 2. After clamping the cover in place, the furnace atmosphere is purged for one-half hour by passing 15 cubic feet per hour of ammonia gas through it.

Current is then supplied to the electric elements. It usually requires about three hours to heat the furnace up to the required temperature of 950 degrees F. At this temperature, the gears are subjected to the action of ammonia gas for sixty hours. Normal operation at 950 degrees F. consumes 18 to 28 cubic feet of ammonia gas per hour for every 100 square feet of surface being nitrided. Ammonia gas at a pressure of 1 1/2 inches water column (1 ounce per square inch) is fed to the furnace at the rate of 5 to 25 cubic feet per hour, depending upon the size of the load, because operating temperature, type of steel, and surface smoothness all influence consumption.

Temperatures, pressures, and ammonia dissociation (approximately 30 per cent) are checked hourly. At the end of this time, the heat is shut off and the work is allowed to cool for four hours, to about 200 degrees F., while the flow of the ammonia gas is continued. The gas supply is then shut off and the work removed from the furnace.

At 950 degrees F., nitrides of chromium, aluminum, molybdenum, and iron are precipitated along the crystalline planes of the steel, resulting in an extremely wear-resistant case having a hardness of from 93 to 95 on the Rockwell 15-N scale. The core of the nitrided gear blanks have a hardness of only 33 Rockwell C.

The rotor blades are of laminated wood construction. Each blade is made from the same piece of wood to insure uniform density, the

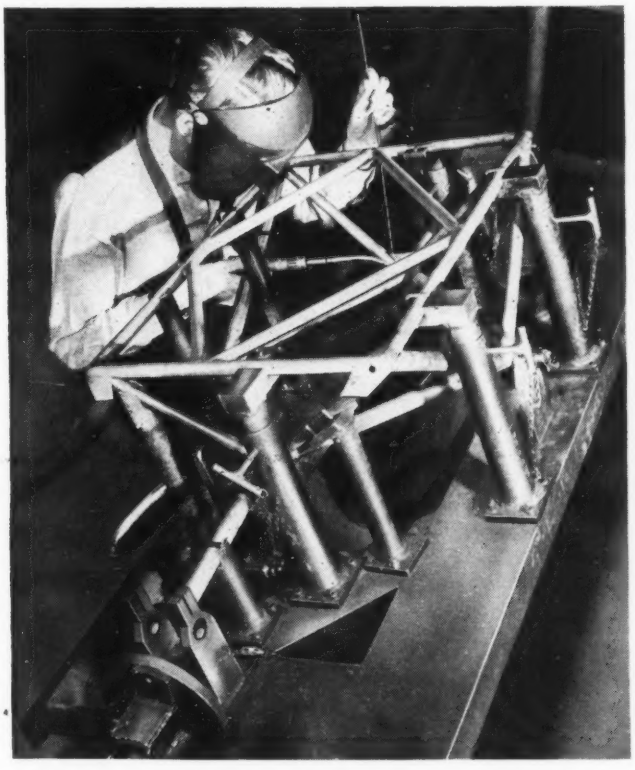


Fig. 1. Tubular Engine Mount for a Helicopter being Gas-welded in a Reversible Table Fixture

Fig. 2. Gear Blanks are Stacked on a Nickel Rack for Loading into the Nitriding Furnace

Fig. 3. (Left) Special Endless-belt Sanding Machine Used to Finish Rotor Blades to Required Profile

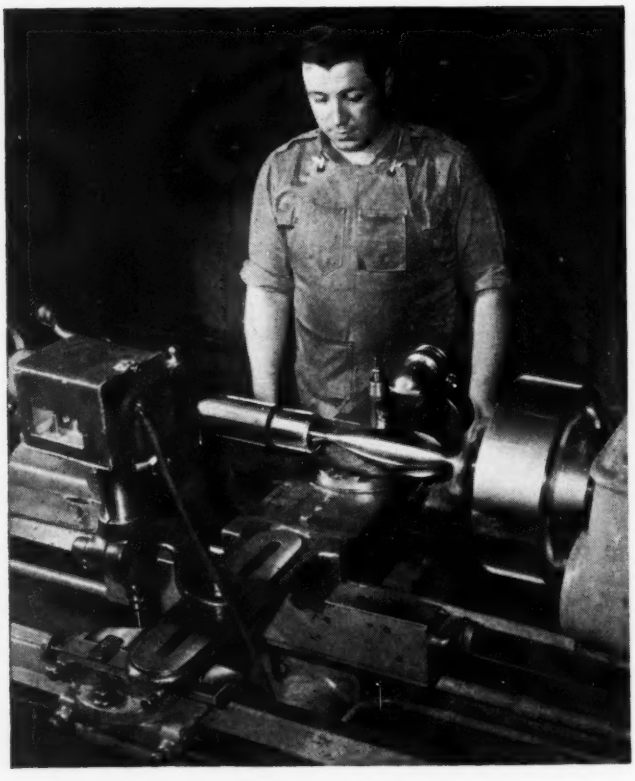
Fig. 4. (Below Left) Stabilizer-bar Weights are Profile-turned on a Lathe Equipped with a Keller Electrical Duplicating Attachment

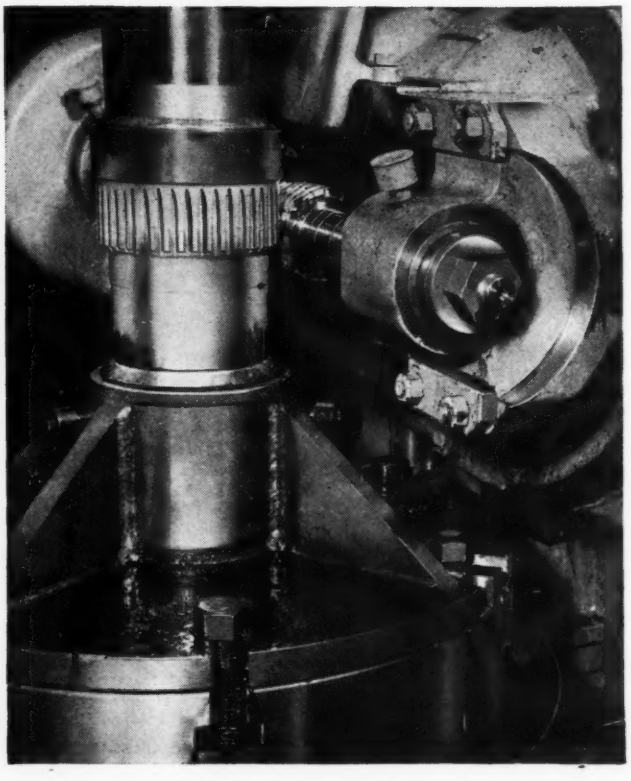
Fig. 5. (Below Right) A Gear-hobbing Machine is Used to Cut a 42-tooth Spline on Main Landing-gear Shaft Assemblies

wood being cut into strips and then securely glued together. The blades are rough-shaped on a wood routing machine, and finished on the special machine seen in Fig. 3, which was designed and built at the Bell plant.

The machine consists essentially of an endless sanding belt, a rotating form wheel, and a table with a fixture that carries the rough-formed blade beneath the belt and wheel. The sanding belt is made of 60-grit garnet paper, 18 inches wide by 41 feet long, and is turned by one belt-driven pulley over three idler pulleys at the rate of 4100 feet per minute. The form wheel shown at the left is made of maple segments having various contours that form a die around the periphery of the wheel.

As the blade is fed below the form wheel at the rate of 7 feet per minute, the wheel makes one revolution, thus flexing the sanding belt to the shape corresponding with that portion of the blade then beneath the wheel. From 1/32 to 1/4 inch of wood is removed from the blade.





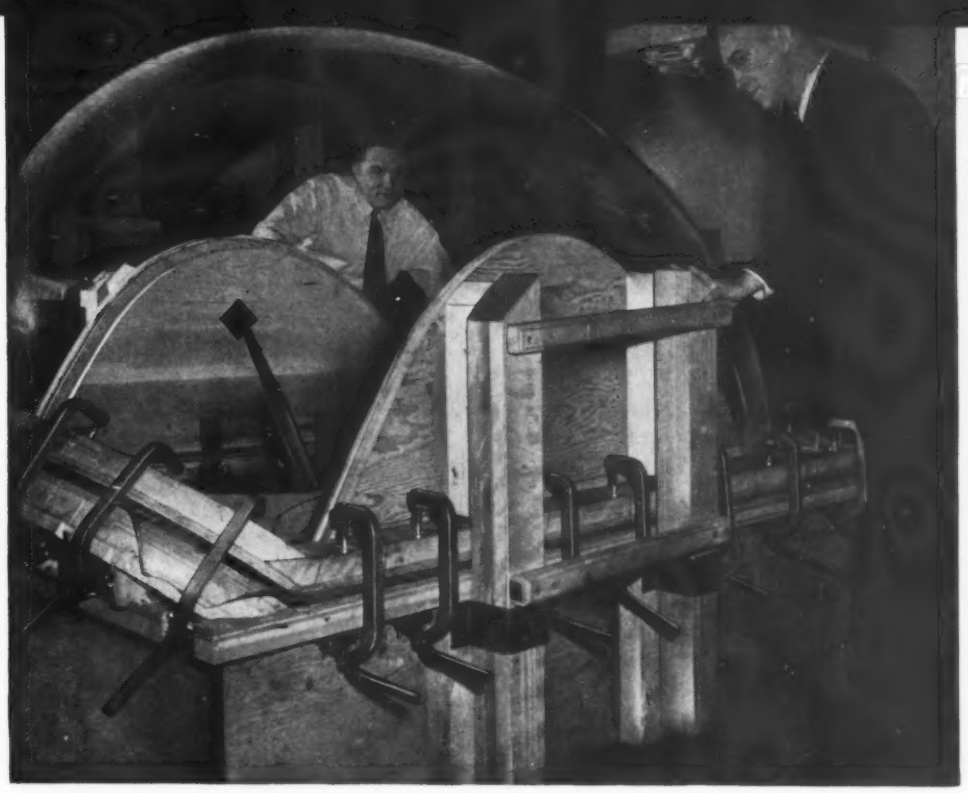


Fig. 6. (Below) Pull Broach, Fastened to the Ram of a Horizontal Broaching Machine, Finishes Gear Openings in Transmission Spiders

Fig. 7. (Right) "Bubble" of Plexiglas, which is Placed in the Front End of the Helicopter for Maximum Visibility, is Blown in a Wooden Form

Stabilizer-bar weights, which rotate on gyroscopic bars 90 degrees from each rotor blade, are profile-turned on a Monarch lathe equipped with a Keller electrical form-turning attachment, as shown in Fig. 4. A tracer point maintains contact with a master templet mounted on a bracket at the back of the lathe and controls both the cross and the longitudinal feed of the cutting tool. The weight, which is forged from S A E 1020 steel, is finished in two operations. Approximately 0.120 inch is removed in rough-turning and about 0.030 in finish-turning, leaving 0.010 inch for hand-filing to a smooth surface. The work is rotated on a live center at 292 R.P.M., and the high-speed steel tool bit is fed at 0.256 inch per minute.

A 42-tooth, 5.250-inch pitch diameter spline is cut on the main landing-gear shaft assembly by means of the Gould & Eberhardt gear-hobbing machine seen in Fig. 5. The shaft is made from S A E 4130 steel tubing, 4.812 inches in diameter by 67 inches long, with a wall thickness of 0.312 inch, to which has been welded the collar on which the spline is machined. The spacing of adjacent teeth of the spline is held to a tolerance of 0.0003 inch. The single-thread hob used for this operation is rotated at 39 R.P.M. and fed at 0.018 inch per revolution. The hob is aligned with the previously machined spline, when additional cuts are required, by the use of red lead.

Spiders, which each hold sixteen planetary gears in the helicopter transmission, are forged from Aeronautical Material Specification 6382 steel. Six gear openings, of rectangular-shaped cross-section, which are spaced at 60 degrees around the periphery of the spider, are broached in a Lapointe horizontal broaching machine with the set-up shown in Fig. 6. About 0.050 inch of stock is removed from the top or bottom surface of a single gear opening at each stroke of the ram. The spider is indexed six times to complete one-half of the surfaces of all openings. It is then reversed in the fixture and the opposite faces are broached. The broach bar is pulled through the work at the rate of 4 feet per minute, with a 4-ton pressure on the ram.

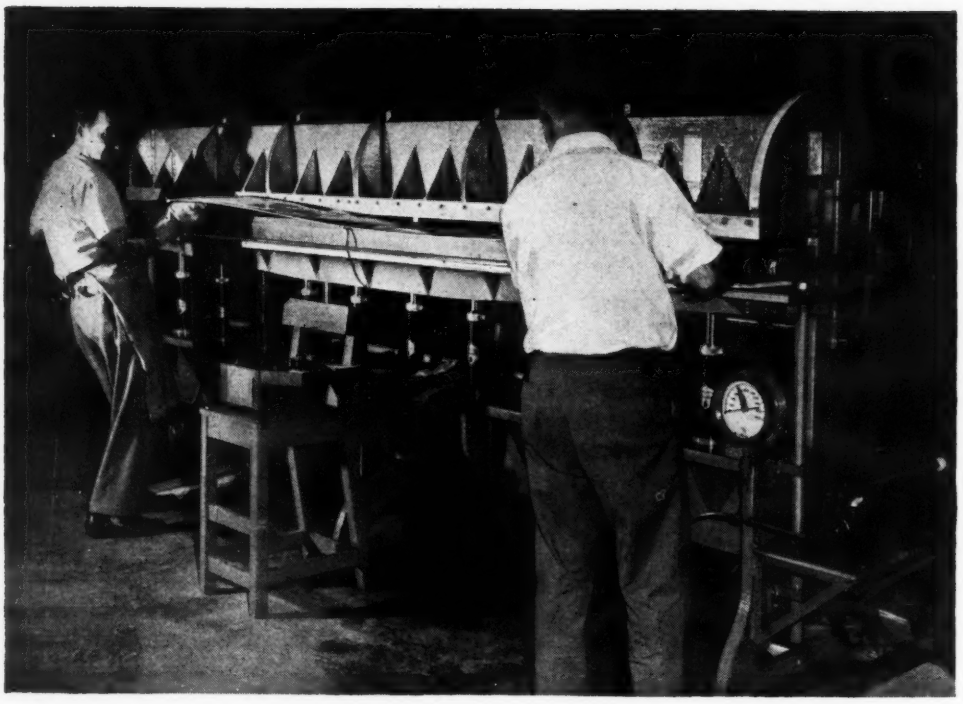


Fig. 8. Special Press Consisting of a C-frame, Hydraulic Jacks, and an Electrical Heater, Used for Bonding Stainless Steel to Wood

The "bubble," or transparent panel in the front end of the fuselage, is blown from a sheet of Plexiglas 81 inches long by 68 inches wide by 5/16 inch thick. The plastic sheet is heated at 280 degrees F. for 2 1/2 hours, and is then placed on the wooden form shown in Fig. 7. Braces, which rest on the edges of the heated sheet, are secured to the base of the form by means of C-clamps. Air at a pressure of 90 pounds per square inch, which is heated to prevent distortion or cracking of the Plexiglas, is then allowed to enter the wooden form until the sheet is blown to the desired height. Only about 5 pounds per square inch of the air pressure is used to form the "bubble," since there is considerable leakage between the braces and the form. It requires about three minutes to form a bubble such as the one shown. The thickness of the Plexiglas sheet is reduced considerably in this forming operation, the finished bubble being about 0.049 inch thick at the top.

The "Cycle-Welding" process, a method of bonding materials developed by the Chrysler Corporation, is employed at the Bell aircraft plant to bond 18-8 stainless-steel wear plates, 0.015 inch thick, to 1/32-inch thick birch veneer strips, which are glued to the leading edges of the rotor blades.

It is essential that the materials to be bonded be clean. Chemical cleaning of the stainless steel has been found impractical, and degreasing, followed by sanding with 60-grit emery cloth is now used. As experiments conducted in forming the parts before "Cycle-Welding" were unsuccessful, the parts are now first bonded and then bent to the desired shape. There is less spring-back and more rigidity of the part by forming in this way.

A thermosetting plastic cement, applied under closely controlled temperature, pressure, and time cycle, is used for the bonding. The cement is sprayed on the mating surfaces of the parts to a thickness of 0.004 inch in an atmosphere of not more than 50 per cent relative humidity. The sprayed parts are cured by allowing them to dry for one-half hour in an oven maintained at 210 degrees F., or for ten hours at room temperature.

The assembled parts are placed on an electrical heater mounted on the bed plate of a hydraulic press. Temperature of the work is maintained at between 325 and 340 degrees F. by means of a thermocouple, connected to a potentiometer which reads in millivolts and is converted to degrees. A pressure of 200 pounds per square inch is applied after the work has reached the specified temperature. As gas or air pressure has been found unsatisfactory for this relatively small force, a special C-frame with a series of hydraulic jacks (Fig. 8) is now being used for this operation. The parts are subjected to this pressure for twenty-five minutes, at the end of which time they have become securely joined to each other.

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Employment in the automotive industry has reached 789,000, or nearly 40 per cent above prewar levels. Weekly payrolls now total $44,000,000—double the average weekly payroll in 1941.

Broaching Jet-Propulsion Engine Parts

THE largest of eleven air-compressor rotor wheels for one type of jet engine requires seventy-eight equidistant slots to be cut around the circumference, as shown in Fig. 1. These slots, which hold the rotor-wheel blades, are circular in shape and must be cut at an angle of 35 degrees in relation to the axis of the wheel. This operation is performed by broaching on a Lapointe 15-ton, 66-inch stroke, vertical single-ram machine.

Fig. 1. Air-compressor Rotor Wheel of a Jet Engine before and after the Broaching of Slots in Its Periphery

The ingenious fixture used on this machine, as shown in Fig. 2, is designed to hold the piece at a 35-degree angle. It can be moved backward, forward, and sidewise to line up successively with each of the three broaches mounted on the ram of the machine. The work is indexed automatically on the return stroke of the broach for the next cut.

In the first or roughing operation, a slot is cut through the periphery of the wheel to a depth of 9/32 inch. This process is repeated until the seventy-eight cuts have been made, when a limit switch terminates this phase of the operation. The fixture is then moved manually into position for starting the second or semi-finishing operation. Seventy-eight passes of a narrower broach increase the depth of the slots to 9/16 inch.

At the conclusion of this series of cuts, the limit switch operates again and the work is positioned for the third and final broaching operation. The broach used for this operation takes a ball-shaped cut, 0.2830 inch in diameter, at the base of each slot. At the same time it trues the entire slot to a width of 0.1175 inch. These dimensions are maintained to a tolerance of ± 0.0005 inch.

Another application of broaching on the jet-propulsion engine is the machining of the rotor blades to fit the slots in the rotor wheel. As the functioning of this type of

Fig. 2. Fixture for Holding the Rotor Wheel at an Angle while Broaching the Slots. The Fixture Can be Moved Forward, Backward, and Sidewise, and Indexes Automatically

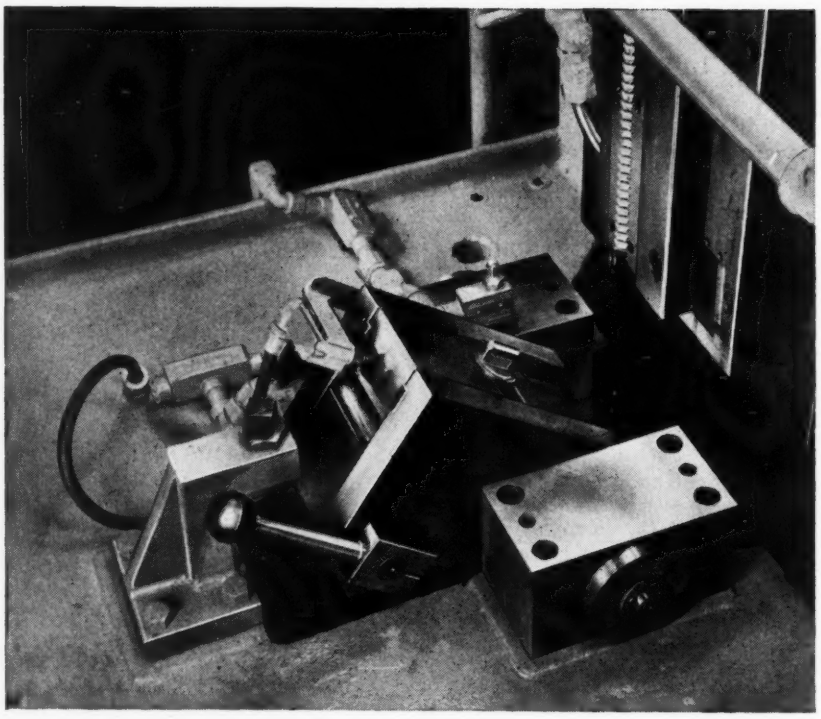


Fig. 3. Fixture Designed to Hold a Rotor Blade while Broaching a Semicircular Contour at Root of Blade

engine depends upon the action of the rotor blades, the fit of the blades in the wheel must be precise. The high speeds at which these parts revolve necessitate a minimum of vibration to overcome centrifugal forces. These blades are broached to obtain the required fit on a Lapointe 10-ton single-ram vertical broaching machine. The work is held in the fixture shown in Fig. 3 while the broach cuts a semicircular contour on the root of the blade.

* * *

Engineering Scholarships Provided by Fafnir Bearing Co.

Annual scholarships to Yale University for sons of the company's employes are being created by the Fafnir Bearing Co., New Britain, Conn., in memory of the late Elisha H. Cooper, who served as president and chairman of the board, and was the first general manager of the company. Mr. Cooper was a graduate of Yale in 1892. Each scholarship is valued up to $1000 a year, and is to apply to mechanical, electrical, chemical, and metallurgical engineering, as well as industrial administration. One scholarship will be awarded each year to a boy entering the freshman class, and he will be eligible for annual renewals three years, making the maximum value of each scholarship $4000. It is hoped that the new scholarships will foster increased interest among young men in engineering studies.

Awards in Lincoln "Design for Progress" Program

Awards in the $200,000 "Design for Progress" Program have been announced by the trustees of the James F. Lincoln Arc Welding Foundation. The first main award of $13,200 was divided among Paul F. Hackethal, chief engineer, Clarence C. Mast, shop superintendent, and Douglas W. Hamilton, welding foreman of the Koppers Co., Baltimore, Md., for their co-authorship of a paper entitled "Development of Arc-Welded Propeller Hubs."

The machinery classifications of the program received the largest number of papers and some of the most outstanding ones. Among the papers receiving awards under this classification were one by G. J. Storatz, of the Road Machinery Division, the Heil Co., Milwaukee, Wis., which won the third main prize of $8200; another by E. M. Barrett, plant superintendent of the Clayton Mfg. Co., El Monte, Calif., descriptive of an automatic drilling, facing, and countersinking machine with an indexing table, which was awarded a prize of $2200; a paper on lifting magnets by Robert J. Neville, superintendent of the Electric Controller & Mfg. Co., Cleveland, Ohio, which received a $1700 award; and one by O. T. Keller, Cincinnati, Ohio, which won a $500 prize. The significance to industry of the savings that are to be achieved by the application of the arc-welding process gains added emphasis from the current upward trend of manufacturing costs and prices.

* * *

Norton Produces New Grinding Films

There has been so much development and progress in grinding procedures and diamond wheels since 1944, when the Norton Co. brought out its first motion picture on the grinding of cemented carbides, that the company is replacing the old film with two new pictures entitled "Grinding Carbide Tools" and "The Diamond Wheel, Its Care and Use." These pictures can be used separately or they can be employed to supplement each other. Technical groups or others interested can obtain bookings of these 16-millimeter sound films from the Norton Co., Worcester 6, Mass.

The Significance of Incentives in the National Economy

By J. W. NICKERSON
Bigelow, Kent, Willard & Co.
Boston, Mass.

Abstract of an Address Recently Presented before the National Conference of Business Paper Editors

THAT high productivity is the keystone of a high living standard is fast becoming a self-evident truth, not only in the United States, but in labor-governed Great Britain and in Russia. The United States has demonstrated that in a free competitive economy living standards have risen as productivity and wages have increased and as costs and prices have decreased.

According to the Bureau of Labor Statistics, the total gain in productivity in the manufacturing industries for the twenty years between World Wars I and II was 125 per cent. During the same period, average hourly earnings rose 28 per cent, unit labor costs dropped 44 per cent, and wholesale prices of manufactured goods dropped 38 per cent. On the other hand, since World War II, hourly earnings have greatly outdistanced productivity—a serious condition, which threatens our standard of living, particularly if sales volume and employment shrink.

Today, labor, management, and Government agree, as a generality, upon the importance of high productivity. Unfortunately, productivity cannot be gained on a general basis until it is accomplished in specific instances. But in thousands of specific instances there are opposing opinions. Obviously, in view of the general agreement on the importance of productivity, these individual conflicts should be eliminated. In fact, their elimination is the most important problem in our industrial life today.

To secure maximum productivity in specific cases, the man on the job must feel sure himself that the conditions surrounding the job and the policies of management are completely fair and to the direct interest of himself and his coworkers. There must be mutual confidence, respect, and understanding. Labor has always been torn between fears as to the security of its jobs, and hopes as to the proper distribution of the fruits of its efforts. Management must not only perform the mechanical engineering job of perfecting manufacturing methods, but must also solve the problems of human engineering. It must understand clearly the fears, the hopes, and the aspirations of labor and its representatives. It must be willing to work out in agreement with labor the relationship that is to exist between what labor gives and what it receives.

What labor gives may be grouped into three categories, in each of which incentives may be used: (1) Its time or presence on the job; (2) its daily physical and mental efforts toward high productivity; and (3) its participation in technological improvement—its contribution in ideas.

Incentives for Labor's Time or Presence on the Job

In order to avoid high labor turnover and provide continuity of operations, every company desires to have employes who will remain with it for years and who will be on the job every day. Various incentives are used to make the employes feel that the company is a good one to work for.

In the first place, hourly rates of pay are established, balanced as to skill, responsibility, and working conditions, and in good standing relative to competitive and community rates. Beyond this, foresighted managements consider such added inducements as pension or profit sharing retirement plans, savings plans, mutual benefit associations, vacations, stabilization of employment, employe publications, and so on. All of these may be considered as incentives toward securing and retaining employes in a plant. They may or may not be more of an incentive than the equivalent in straight wages, depending on local conditions and the point of view of the employes.

Plants that operate on a straight hourly-rate basis have no financial incentive to compensate for the varying capabilities or effort of their employes other than promotions which may be made on the basis of merit. In order to secure from each employe his continuing best effort, a high degree of leadership and cooperation is essential, because increases in effort do not bring forth corresponding increases in pay. Such a plan, however, may well be preferred to a poorly conceived or poorly maintained incentive plan.

No company that must compete with others should fail to consider wage incentives. Reports

on the operation of new wage incentive plans indicate that, on the average, an increase in productivity of about 40 per cent occurs in the first ninety days of operation. Wages increase an average of 15 to 20 per cent, and costs decrease 10 to 15 per cent. Nevertheless, wage incentive plans are not panaceas; nor are they self-operating devices. Too often they have been established merely with the object of increasing profits, regardless of their inherent justice. Too seldom are they considered the means of establishing the fairest method of compensating employes in proportion to their efforts.

Guiding Principles for Wage Incentive Plans

During the war, the War Production Board established several basic guiding principles for wage incentive plans. A revision of these principles best suited for post-war practice may be summarized as follows:

Basic Wage Foundation—There should be a sound competitive guaranteed hourly rate structure, based upon an evaluation of the skill, responsibility, and working conditions inherent in the various jobs. If, on the same job, it is desired that employes should have varying individual rates, then such measurable factors as productivity, quality, length of service, regularity of attendance, and versatility should be used.

Simplicity—The plan should be as simple as practicable, without inequities. Workers should be able to understand the effects of their efforts on their earnings.

Quality Control—The desirable and economic degree of work quality should be determined and maintained.

Establishment and Control of Standards—To secure lowest costs and to prevent uneven standards and inequitable earnings, the use of an incentive plan should be preceded by basic engineering improvements in product design, manufacturing equipment and methods, scheduling, and material handling. Then, through the use of detailed time-study procedure, elemental standards should be established by management for each unit of an operation. These standards should represent the amount of work performed by a normal qualified operator under normal conditions. Once set, these elemental time standards should not be altered, except to make them correspond to changed conditions, unless by agreement between management and labor. However, it is essential to progress that constant thought should be given to improvements in methods, materials, and equipment. In every case, time standards should be brought exactly in line with the new conditions.

Units of Application—Standards applied to individuals or to small integrated groups are most effective. At times, owing to difficulties in recording production, and to the possibilities of teamwork, group standards may be advisable.

Broad Coverage—It is desirable that the incentive plan cover as many employes as possible. The efforts of indirect workers and clerical workers are often as readily measured as those of direct workers. When this seems difficult, they may sometimes be tied in on a ratio basis with the direct workers whom they serve.

The Productive-Incentive Relationship—With well engineered standards, it is best to use an incentive plan in which earnings in excess of standard are in direct proportion to the increased production.

Understanding of Human Relations—A wage incentive plan may be either a constructive force for increased production, better quality, and good labor relations or it may be the means of disrupting an organization. Management should be prepared to direct its best thoughts to its installation and maintenance. Management, while necessarily retaining its own functions, should be sure that it has the general understanding and agreement of labor regarding the program.

Labor's Participation in Technological Improvement

The installation of wage incentive plans, designed to pay additional wages for additional effort, has increased productivity and decreased labor cost from the day-work level to the incentive level. To remain at this point would be stagnation. Productivity should be continually increased and labor cost decreased by changing standards as the result of technological improvements in manufacturing processes.

Many companies, when standards have been established and incentives for effort applied, "lie back on their oars," feeling that they have arrived at the "one best way." Someone, however, should immediately be given the job of finding the "better way of tomorrow." Someone should be given the job of keeping and submitting a periodic record of the net reductions or increases in labor cost due to changes in standards. Such a record is the barometer of a company as to technological progress in so far as the element of labor is concerned.

Management should strive to bring to a minimum the possibility of those negative results which have been associated with technological improvements and which workers have learned to fear. The greatest of care should be taken so that method changes do not result in loss of em-

ployment, and transferring to other jobs should be done with wisdom. Also, proper thought should be given to the training and assisting of workers to accommodate themselves to new conditions.

Reasonable managements have always taken such steps. However, something of a more positive nature is necessary if the aim is to have individual employes and unions desire an improvement of methods, with the corresponding rectification of standards. That "something" is the prompt participation by labor in the savings in labor costs which it is estimated by management will actually be attained. This may be called an "incentive for ideas."

Proposed Plan to Share Labor Cost Reduction with Employes

The problem in the establishment of an incentive system is to find a solution that will leave the wage-payment structure balanced and intact and will not be as remote and diluted as the ordinary profit-sharing plan. A lump-sum labor cost reduction bonus should be paid to workers whenever a change in incentive standards has become an actuality. The details should be flexible. No stereotyped plan should be applied in a plant without knowledge of local conditions and of the attitude of all those interested.

The following features are significant:

1. Whenever there is a change in manufacturing methods, equipment, or conditions, there should be a corresponding change in the time or productivity standards, so that these standards will remain uniform and necessitate only a reasonable measure of effort.

2. The new methods and standards should be put into effect by management with all necessary understanding on the part of the employes or representatives. There should, of course, be an opportunity for appeals by workers through the regular grievance procedure in cases of misunderstanding.

3. After new standards have been in effect long enough to be considered accepted, say one month, a calculation should be made of the estimated first year's net saving. This would be equal to the known reduction in labor cost per unit of production, multiplied by the forecast number of units per year, with adjustments for the expense of making the change. In some instances, this number would be subject to considerable variation. If necessary, later calculations could be made.

4. A decision should be made as to the amount of lump-sum bonus to be paid as a portion of the first year's savings.

a. In the case of method changes initiated by management, this may be, say, 20 to 30 per cent. For example, if the engineering division designs an automatic device that will enable an employe to run two machines instead of one, and if the yearly saving is estimated at $10,000, the amount distributed may be $2000. The method of distribution would depend on the organizational structure and other local conditions. If there are ten employes whose jobs are principally affected, each may be issued a check for $100. The remainder may be apportioned partly to a departmental pool and partly to a pool to be distributed to the division or the entire plant when its size has reached a certain amount.

b. In the case of method changes initiated by a non-supervisory employe, the award or bonus may be, say, 40 to 60 per cent. A reasonable portion of this may go to the suggester, another portion to those affected by the change, and the remainder into a pool or pools. The fact that all those whose work is affected even remotely by the change would participate in the savings would tend to eliminate hostility toward those who propose methods of reduction in labor cost. There would be tangible and immediate evidence that technological improvements are beneficial.

c. Although the goal should be to institute technological improvements gradually enough to prevent lay-offs, as time goes on there may be necessary business curtailments for other reasons. A portion of the created pools could be reserved for a stabilization fund.

d. Incentive systems, unfortunately, are usually fraught with loose standards. They are caused either by management's errors in judgment, uncooperative studies, or small and intangible method changes. It is unwise for management to attempt to alter such standards. They are often, however, as troublesome to unions as to managements. When both groups agree upon new studies in such instances, management should be willing to make very considerable distributions of savings, perhaps 100 per cent of those estimated for the first year.

e. It may be desirable to all concerned to include supervision in the award. If so, a certain percentage of the award or the pool may be so distributed.

Many variations in the plan proposed may be necessary in individual plants; no doubt new and important phases will arise. However, with leadership and cooperation, the application of these principles may well steer labor and management in the direction of better human relations and increased productivity, with their ensuing mutual economic advantages.

Engineering News

Electronic Timer Designed to Measure One-Billionth of a Second

An electronic timer, designed to count and measure the speeds and energies of nuclear particles released during changes within the core of an atom, has been perfected by Dr. Schultz of the Sloane Physics Laboratory at Yale University. This instrument, capable of measuring time intervals as brief as one-billionth of a second, is a refinement of measuring devices used in wartime radar. Its operation depends on the synchronization of "counters" that detect an electrical pulse in the circuit; timing is accomplished by measuring the delay necessary to synchronize these counters.

In addition to the previously mentioned applications, the device has proved valuable in measuring the lifetime of many atomic nuclei that disintegrate almost immediately on forming.

New Boeing Planes Equipped with Elaborate Anti-Icing Devices

Thermal systems have been designed by Boeing engineers to prevent icing of all the key airplane components during high-altitude flight. Separate devices are used to keep the wings, tail, propellers, and the glass in the control cabins free of ice.

Wing and tail surface anti-icing is accomplished by heated air, flowing through passages in the leading edges. Eight combustion heaters —three in each of the outboard engine nacelles and two inside the tail—heat the air to 330 degrees F., sufficient to maintain a differential of 100 degrees between the outer and inner temperatures. If the outside air temperature is 20 degrees below zero, the leading edges would be approximately 80 degrees above zero.

Resistance heating elements keep ice from forming on the four-bladed reverse-pitch Curtiss electric propellers. Running lengthwise in each blade, the elements are connected in series; by means of a timing mechanism, only two opposite blades in one propeller are heated at a time. Anti-icing power is switched on by the pilot when needed. Each two blades draw 160 amperes, so that a total of nearly 4500 watts of electrical power is coursing across the propellers continuously.

Finally, panels of electrically heated Nesa glass insure clear visibility in the control cabin. This material, a development of the Pittsburgh Plate Glass Co., is a sandwich of plate glass, coated with an electrically conductive material, and vinyl plastic. By passing a current through the coating, regulated heat can be applied to the glass, thus keeping it ice and fog free during adverse weather conditions. An alternator provides the power for the heat, and Thermistor elements control the flow of current.

Shielding Principle Provides Electronic Micrometer

The principle that the field surrounding a coil carrying alternating current will induce current in an adjacent coil, and that the amount of current thus induced can be controlled by placing a shield or a low-resistance conductive medium at various distances from the latter coil, has been employed to make a linear reading device for use as an electronic micrometer. The shield is placed not between the primary and secondary coils, but adjacent to the latter. Its distance from the secondary coil determines the amount of energy produced in this coil.

This new device, developed by the National Bureau of Standards, was primarily designed to afford a means for measuring the thickness of the oil film in the bearings of a large Navy turbine-shaft. The electronic micrometer utilizes the fact that radio-frequency energy radiated from a coil is zero at the surface of a perfectly conducting shield adjacent to that coil. Compensation for the necessary thickness of the coil has been included in the design.

The coil assembly is mounted on a movable shaft in such a manner that it can be caused to approach or recede from a metallic plate. The material to be measured is pressed lightly between the pick-up coil and the metallic plate. When the material is removed, the amount of current generated in the pick-up coil is an indication of the thickness of the material that occupied the space. The meter indicating the output of the coil is calibrated in thousandths of an inch, in order to give a direct measure of distance or thickness.

When the electronic micrometer was used to measure the displacement of a turbine-shaft in

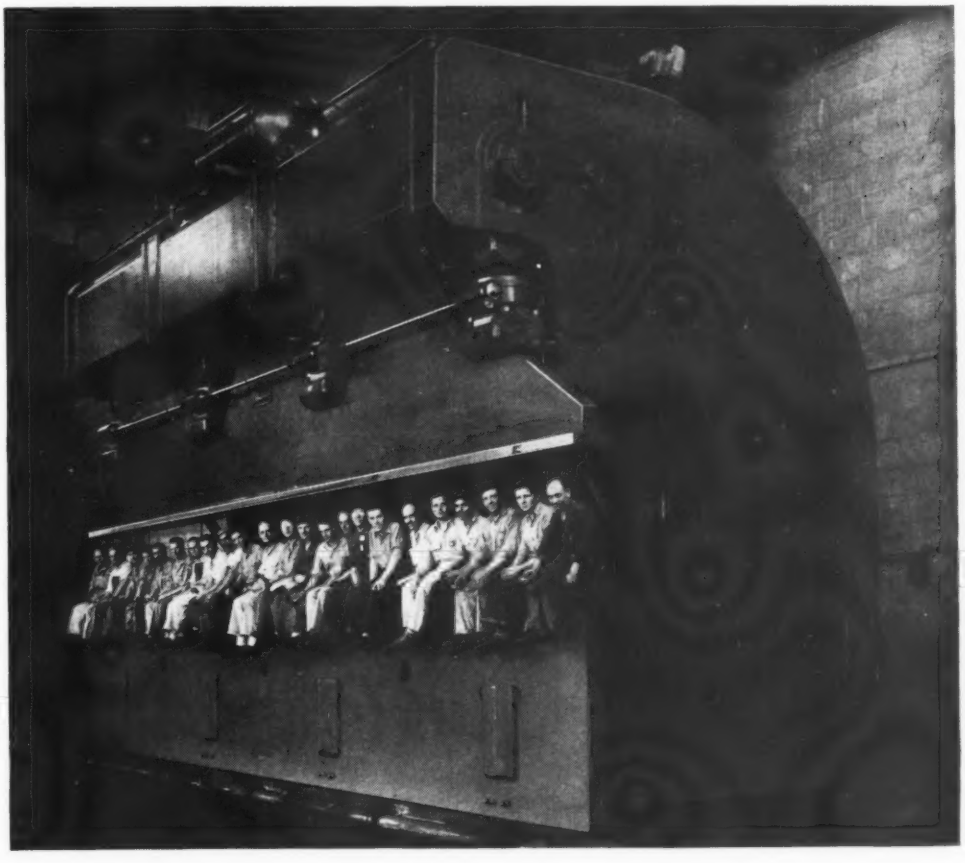
its journal, four of the devices were spaced equally around the shaft. This arrangement was so sensitive that a 0.01-inch deflection of the center of a 6-inch diameter shaft provided a 2-inch deflection of the center spot of the oscilloscope cathode-ray tube. The micrometer is about 1/2 inch in diameter by 1/4 inch long, and is able to measure distances from 0 to 0.02 inch. Readings to 0.0001 inch are easily obtained. The indication on a meter is linear to within a fraction of 1 per cent.

Another application of the device is in a tachometer or speed indicator. Here, the end plate of a fly-ball governor may be so mounted as to approach or recede from the pick-up coil as the speed of rotation of the governor increases or decreases.

Mechanical Press Brake of Giant Size Exerts Pressure of Over 1000 Tons

A mechanical press brake of gigantic size, built by the Warren City Mfg. Co., Warren, Ohio, has recently been installed in the McKeesport, Pa., plant of the Jones & Laughlin Steel Corporation. Of fully stress-relieved welded steel construction, this new "Warco" press brake weighs in excess of 500,000 pounds without dies. The machine is designed to exert a pressure of over 1000 tons for bending to a right angle, in a single stroke, steel plate 5/8 inch thick, in lengths up to 36 feet. The press makes fifteen strokes per minute, and all moving parts are counterbalanced by air cylinders. The flywheel of the machine weighs over 10,000 pounds, and rotates at a speed of 450 R.P.M., being driven by a 75-H.P. electric motor.

This huge machine is controlled by an operator stationed at a finger-tip control electrical push-button station. Setting of the ram is electrically controlled by means of push-buttons and indicators showing the exact ram setting within 0.001 inch. All lubrication is centralized at one position. Owing to the great weight and size of this press, which is over 36 feet long, 16 feet front to back, and 20 feet high, it was necessary to dismantle the brake for shipping in five separate freight cars. The four body sections, each weighing over 50,000 pounds, were shipped in special well cars to provide sufficient overhead clearance.



Huge Mechanical Press Brake Weighing More than 500,000 Pounds and Capable of Exerting a Pressure of over 1000 Tons

Aluminum Timing Gears with Integral Steel Hubs

Aluminum timing gears with bonded steel hubs are reported to be much stronger than the molded resin-and-fiber gears commonly used in automobile engines. They have a much longer life because of the better wearing qualities of aluminum, and they stand up better under heavy loads. The aluminum-alloy gears are chemically bonded to the steel hubs by a patented process developed by the Al-Fin Corporation, a subsidiary of the Fairchild Engine & Airplane Corporation. The bond has a tensile strength of 6000 pounds per square inch. Camshaft timing gears made by this process have been operated over 100,000 miles under severe loads without failure.

Which Should You

By CHARLES R. CORY, Engineer in Charge of Die Designing, Fisher Body Division, General Motors Corporation

WHETHER a part can be shaped in a forming die or must be made in a more expensive drawing die—either single or double acting—followed by a trimming die depends primarily on the tendency of the part to wrinkle or tear. It also depends on the thickness of the metal, the depth of the draw, and the height of the flange to be formed. Specification of the die to be used for a particular application must be governed by experience and a knowledge of the operation and construction of the various types.

In general, a part requires a drawing die if wrinkles of excess metal or tears would result from the solid spanking action of a forming die. A case where a forming die is not suitable is shown in Fig. 1. The cross-sectional view at *Y* shows the blank resting on the pressure pad *A*, which is supported by air pressure pins *B*. The depression at the center is produced by the punch *C* forcing the blank into the matching shape of the pressure pad while the pad is still in an "up" position. The pad is then forced down, as shown at *Z*, and the outside flanges of the part are formed by the stationary flanging members *D*.

The part could not be formed successfully in the die illustrated, since it would wrinkle around the center depression as the metal moved inward. The same effect would result from trying to form a sheet of paper to this shape. Wrinkles would start in the walls of the depression at *E* and would increase in size or number across the face of the part up to the edge of the blank. These wrinkles could not be spanked out, as such action could not eliminate excess metal without squeezing it to the edge of the blank. This would occur only if the metal was of heavy gage and thus more capable of lateral flow.

This type of part should be produced by the use of three dies—a drawing die for making the depression; a trimming die for trimming the outside edge; and a flanging die. Or a drawing die could be used for the depression, followed by a combination trimming and flanging die.

Action of Drawing Die Best Suited for Cupping Deep Parts

In view *Y*, Fig. 2, a drawing die is shown at the point where the drawing action starts. The blank is resting on the top surface of the binder ring *A* which is supported by air-pressure pins *B*. The upper die *C* is about to force the binder ring downward, wrapping the blank around the stationary punch *D*. The top surface of the binder ring *A* is made flat as the trim line is in the binder surface. The upper die *C* is also the upper shoe; however, a separate die and die shoe can be employed if it is desirable to use flat commercial die shoes.

The upper die need not fit the part all over but only where a spanking action is necessary; it clears the part above the punch area, since the metal will wrap around the punch with no tendency to wrinkle. The metal around the radius at the base of the depression at *D* is spanked by the upper die to "set" any loose metal.

At each end of the upper die is a guide-pin boss which carries a heel plate *F*. The heels are required to take the thrust of the drawing action at the rear, which starts before the drawing of the front of the part because of the greater depth of the piece at the rear.

The air-operated binder ring *A* is guided by blocks *G* at the four corners, as shown in the plan view of the die at *X*. It could be guided by fitting it to the side of the punch if preferred. Retainer screws *H* prevent the binder ring from falling if the die is turned over during repair. When the drawing operation is an easy one, and

Specify—Drawing or Forming Dies?

air pressure is not available, springs can be used to operate the binder ring. In that case, the retainer screws will, in addition, limit the compression of the springs as required. The binder surface must be at least as large as the blank; otherwise wrinkles will form in that part of the blank extending beyond the binder surface as the blank is pulled inward, and tears will result.

The blank size may be estimated by measuring the length of the cross-section of the part, allowing stock for finish-trimming, and making deductions for the stretch of the metal and the fact that the metal converges as it pulls in. If the binder surface were not flat, there would be more incentive to reduce the area, since it is costly to spot two irregular binder surfaces together and to keep them spotted correctly as the surface wears. The question of whether the blank will be square-sheared to a rectangular shape, square-sheared to cut off corners, rotary-sheared, or rough-blanked in a die has a bearing on the amount of binder surface required.

The bottom shoe, as well as the upper die or top shoe, has a clamping flange *J* for fastening it to the press. Guide pins *K* are provided to keep the two shoes in lateral alignment. If the shapes of the part and the binder surface are such that side thrusts occur at different times or in different directions, an interlocking or three-way heel can be used at each end of the die for aligning the shoes. This heel is similar to the one shown at *F*, except that there are heel plates at the front and rear and outer sides of each heel. In such a case, guide pins are not necessary. Dies operating in large presses, whose rams are not usually very well guided, should have interlocking heels to correct the misalignment of the ram. The heels should be interlocked for a distance greater than to the maximum depth of draw.

Gage pins *L* should be provided on two sides of the die, usually at the rear and left side. They are provided when the die is tried out, since the blank size must first be determined by trial. The outline of the square-sheared rough blank before the drawing operation takes place is shown at *M*. During the drawing operation, the blank is pulled inward to outline *N*, moving very little at the corners and a maximum amount at the center of the sides. A sheet-metal guard *P* surrounds the binder ring and prevents anything from getting under the ring when the die is open.

The construction of a column press favors unloading the part at the rear, while that of a gap press permits unloading either at the rear or the side. The rear operator can be eliminated by the use of an air-cylinder operated kicker or by blowing the part off the die area with a blast of air; or the front operator can simply push off the drawn part with the blank. Whether the unloading is done at the front or the rear, the gage pins should be at the front (although this makes it a little more difficult to load the blank); if the gage pins are at the rear, they must be made to drop below the binder surface momentarily. Many other types of mechanical unloaders can be devised.

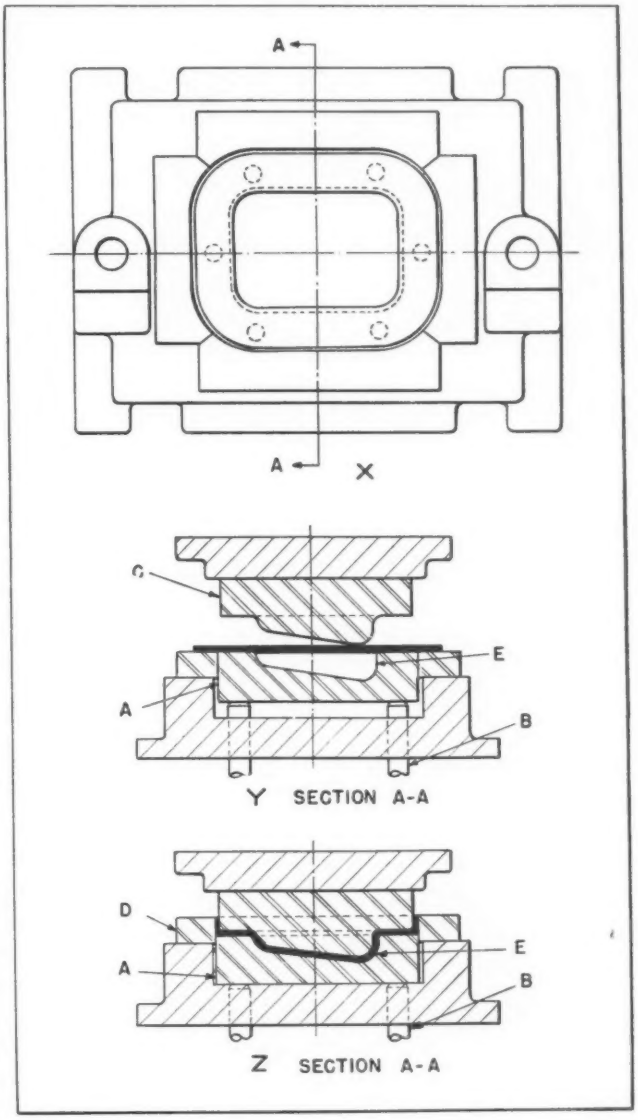


Fig. 1. Plan View X and Sectional Views Y and Z Illustrate the Difficulty of Producing a Part of the Type Shown in a Forming Die. The Solid Spanking Action on the Metal Would Cause Wrinkles to Form across the Face of the Part

If it were not for the squeezing pressure exerted on the blank by the air pressure of the binder ring, the blank would be wrinkled badly as it is formed by the punch. However, the pressure of the binder ring on the blank acts as a brake on the flowing in of the blank metal, so that the metal is always under tension and pulls in only where and to the extent that it is actually needed. If enough squeezing pressure is exerted, the metal tension is such that no wrinkles will form. If the pressure is too great, the metal will tear rather than pull through the binder surface. A successful drawing operation lies in the range between not enough binder pressure (which permits wrinkles) and too much binder pressure (which will result in tearing the metal). The shape of the part determines whether such a compromise is possible. A part that is easy to draw has a wide range of successful drawing pressures, whereas one that is hard to draw has a very narrow range. In some cases, even the commercially permissible variation in ductility will result in an excessive percentage of scrap.

Since it is uncertain as to what proportion of the "draw in" will come from any one side in successive pieces, a drawn stamping usually must be trimmed after the draw rather than blanked to the developed size before the draw. This is a disadvantage of drawing dies, because a trimming die is more expensive than a blanking die, is slower operating, requires a right- and left-hand die if right- and left-hand parts are needed, and wastes more metal, as allowance must be made for finish-trimming.

Combination Drawing and Flanging Die Used for Thin Shallow Parts

Within certain limitations, a part of the type being considered could be produced by a combination forming and drawing die, as shown in Fig. 3, preceded by a blanking die. In this case, the blank is held between the pressure ring *A* and the air pressure pad *B*. As the springs of the pressure ring *A* collapse, the punch *C* forms the blank into the center depression of pad *B*. Later, pad *B* is forced down and the outside flanges are formed by the flanging ring *D*.

The use of this type of die is limited to parts that do not require accuracy in the flange height, since the stock may not pull in uniformly, particularly if the center depression is not symmetrical, as in the case illustrated. This type of die should only be used for parts that are thin enough and whose center depression is shallow enough so that the spring pressure of ring *A* can hold the blank flat and free from wrinkles during the drawing part of the operation. A failure of the pressure pads to keep the metal flat will result in wrinkles in the finished part and in excessive die upkeep. The flange metal *E* is not held by the pressure pads while the center depression is being drawn; thus wrinkles may form in the flange metal to such an extent as to separate the pads when the wrinkled surface pulls in to the pressure pad area.

Double-Action Dies Should be Used for Difficult Drawing Jobs

A double-action drawing die should be used instead of an air-operated or single-action one if the air pressure actuating the binder ring is not sufficient to keep wrinkles from forming. A

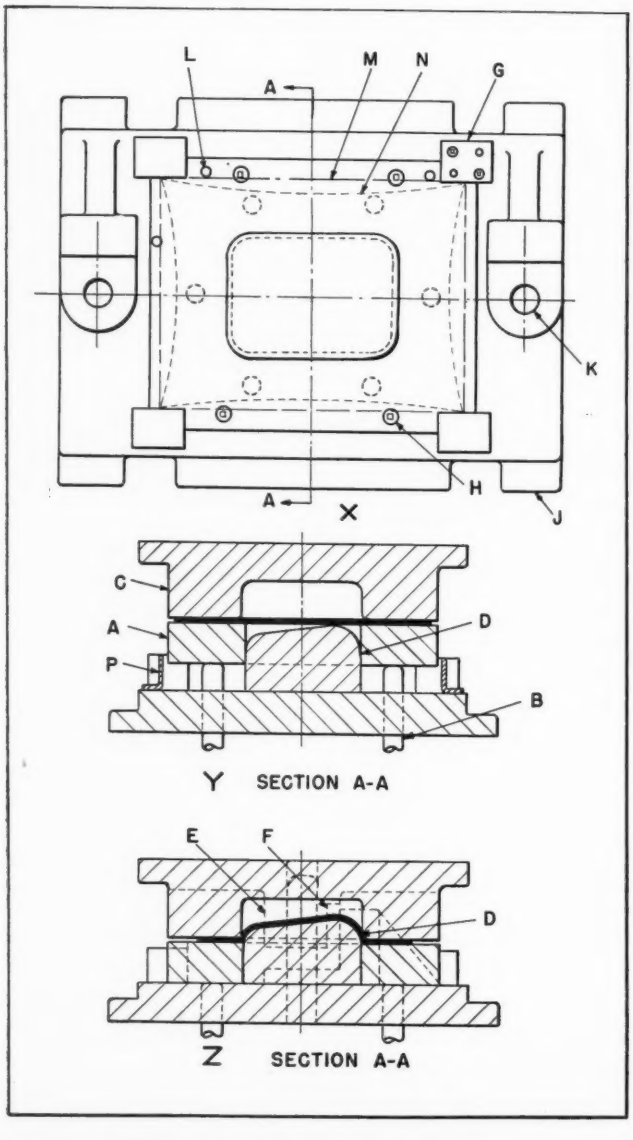


Fig. 2. When Made in a Drawing Die, a Part Has Less Opportunity to Wrinkle, Since the Squeezing Action of the Binder Surfaces on Ring A and Die C Creates Tension on the Metal, so that it Pulls in Only where Needed

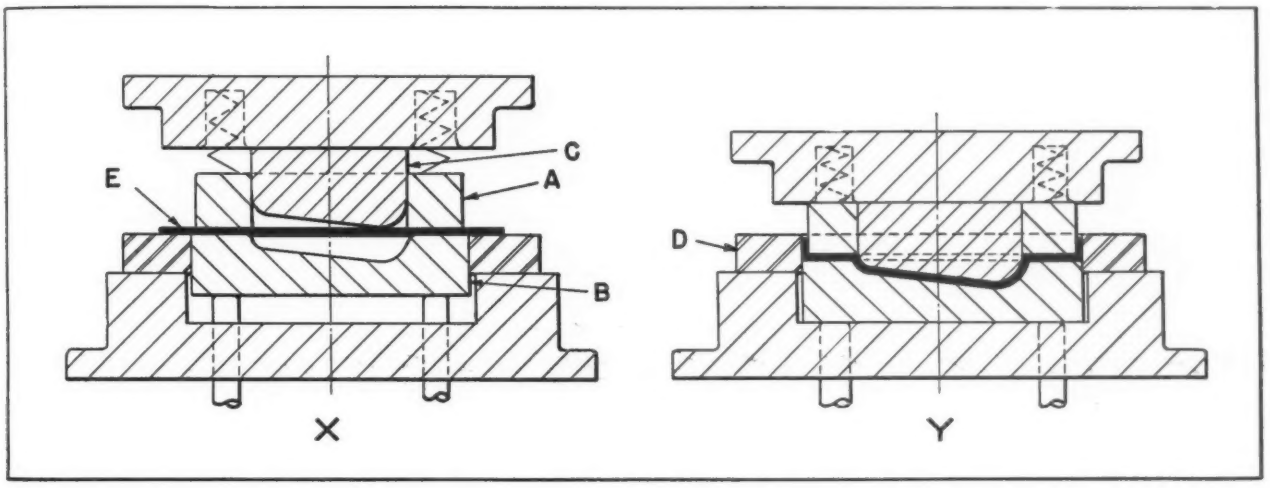


Fig. 3. Once Blanked, a Part Sometimes can be Formed by a Combination Drawing and Flanging Die. The Action of This Die is Such that the Flange is Formed by Ring D after the Center Pocket of the Part has been Drawn. The Position of the Sheet before the Draw is Shown at X, while the Completed Action is Shown at Y

single-action drawing die is preferable if the part is not too difficult to draw, because a single-action or crank press is a cheaper machine than a toggle or double-action press, and usually runs at a greater number of strokes per minute. A single-action drawing die is also somewhat cheaper to make.

A double-action press has two upper rams. As the press starts its stroke, both rams descend, but the outer one reaches the bottom of its stroke while the inner one, operating inside the ring type outer ram, is still a considerable distance from the bottom of its stroke. Through a series of toggle actions, the outer ram remains stationary at the bottom of its stroke for perhaps one-third of a press cycle. During that time, the inner ram completes its crank-operated stroke and starts its up stroke before the outer ram; the two rams then travel upward at about the same rate of speed.

The die used on this type of press is similar to a single-action drawing die, except that it is inverted. As shown in Fig. 4, the binder ring *A* is above and operated by the outer ram of the press, the punch *B* is operated by the inner ram, and the lower die *C* is fastened to the bolster plate of the press.

In a press cycle, the binder ring is brought down by the outer ram and exerts pressure on the blank while the punch is still a considerable distance from the work. The binder ring continues to exert pressure on the blank as the punch travels downward to shape the part. The distance the punch still has to travel after the binder has closed on the blank represents the depth of draw possible on that particular press. This depth of draw can be increased to the extent that the punch can bulge the blank down before the binder closes without producing wrinkles in the blank too deep to be drawn out by the subsequent drawing action.

The pressure exerted on the blank is governed by the tonnage of the outer ram rather than the tonnage of an air cushion, as in the case of a single-action drawing die. This pressure can be high enough to prevent the blank from pulling inward, and thus may cause it to tear. However, the greater amount of blank-holder pressure makes it possible to use drawing beads or spleens *D;* these cannot be used as effectively in a single-action drawing die unless the stock is thin.

The drawing spleens are of half-round soft steel and are riveted in a shallow groove, chipped or machined in the binder-ring face. Spleens are usually added when it is impossible to hold the blank tight enough to prevent wrinkles without, at the same time, holding it so tight that the metal tears. As the metal flows through the bead shape the wrinkles are ironed out with less squeezing pressure.

Often it will be noticed in a drawn stamping that there are wrinkles up to the spleen but not through it. This indicates that the wrinkling tendency (from the unequal rate of metal flow across the binder-ring face) has worn clearance grooves in the binder-ring face as far as the spleen, but the spleen has prevented wrinkling to such an extent that no grooves are worn in the binder face inside the spleen line. In trying out the die, it may be found that it is sufficient to use a spleen locally rather than around the entire punch contour; or it may be found that a second or third row of beads is required at the location of a specially severe draw.

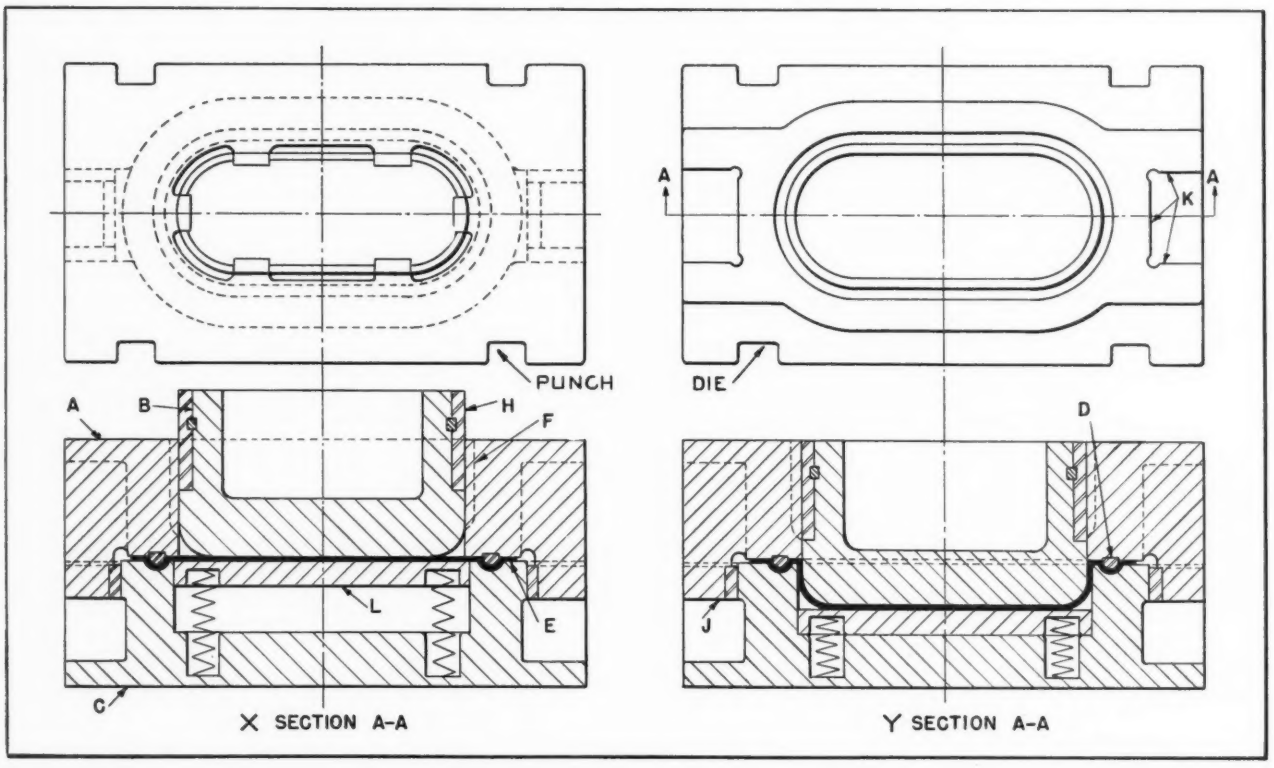


Fig. 4. A Double-action Drawing Die, Shown Partly Closed at X and Closed at Y. Since This Type of Die Requires a Double-acting Press, which is More Expensive than a Single-action Press, it is Used Only for Parts that are Difficult to Draw

The binder ring and die are aligned either by guide pins or heels or both. In the die shown in Fig. 4 the binder ring *A* has a three-way inside heel *J* that engages the outside three-way heels *K* of the lower die and thoroughly interlocks the two members. In large dies, it is safer to use interlocking heels even though there is a symmetrical drawing condition and no side thrusts. For a smaller die, operating in a smaller press, particularly if the production requirements are not heavy, guide pins are sufficient. If there are unbalanced thrusts, one-way or two-way heels can be used in addition to the guide pins.

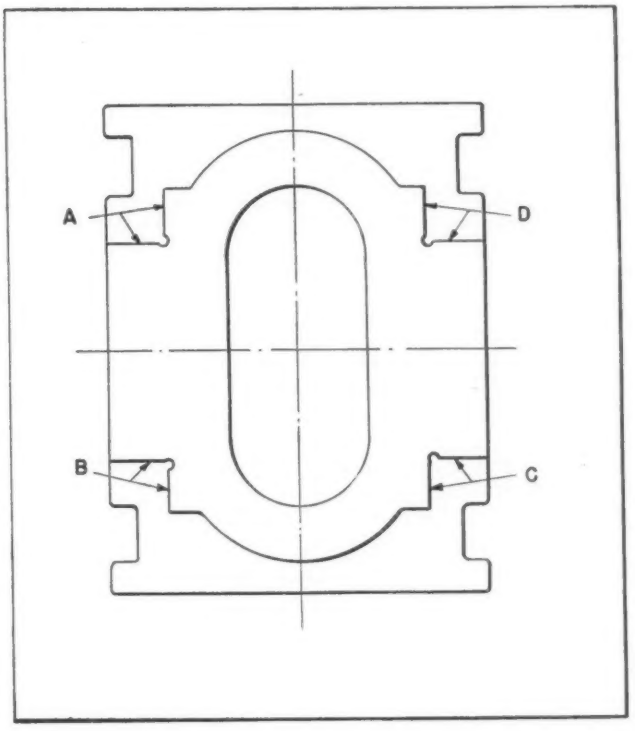
The heels are located at the sides of the die in Fig. 4, assuming that the part extends sidewise of the press. However, the die can be designed so that the part extends from front to back of the press, as in Fig. 5, if the die operates in a press with an inner ram large enough to cover the punch. The advantages of locating the part to extend from front to back are that the operator is not required to reach so far in the press for the finished part, and in some cases two drawing dies can be used in the press at the same time. To avoid the closeness or short leverage of two three-way heels located at the center of each side, the die shown in Fig. 5 is equipped with four two-way heels with heel surfaces on each side represented by *A*, *B*, *C*, and *D*.

The punch *B*, Fig. 4, has six guide strips *H* of hardened steel which are keyed to prevent shifting. The die *C* contains the lower binder surface. The flat binder surface provided in this design can be machined, but irregular binder surfaces must be spotted together for a good fit. The harder the drawing condition, the more carefully this spotting is done. As rams and bolster plates are not always horizontal and flat, and deflect more in the center than at the sides, a drawing die must have its binder surfaces spotted whenever it is used in a different press, and sometimes when put back in the same press.

Die *C* contains a spring stripper for ejecting the part, with its vertical walls, from the die. Although the stripper would not need to travel up flush with the binder surface to eject the part, it is advisable for it to do so in order that the finished part can be pulled off the die without first lifting it. Even though the part did not require stripping from the lower die, it would pay to provide a spring stripper or spring pins to lift the part, in order to facilitate removing it. In cases where an automatic unloading device is used to push or pull the part out of the die, a lifting device is essential.

Another advantage of a double-action die, besides the greater binder pressure available and the possibility of using spleens, is that the binder pressure on the blank can be adjusted independently at the four corners of the ram to give more

Fig. 5. If a Double-action Drawing Die Operates in a Press with an Inner Ram Large Enough to Cover the Punch, it Can be Designed so that the Part Extends from the Front to the Back of the Press. This Results in Easier Material Handling and Sometimes Permits the Use of Two Dies in the Same Press. Four Two-way Heels A, B, C, and D are Used to Align the Upper Binder Ring and Lower Die



or less pressure at different parts of the binder surface. The same result could be obtained in a single-action drawing die by spotting the upper and lower binder surfaces to each other and allowing less vertical clearance where more pressure is required; however, this process is much slower than adjusting the ram, and the surfaces are difficult to maintain.

Special Press Equipment for Double-Action Drawing Die

Some special press equipment is required to adapt a double-action drawing die for use in a toggle press. A blank-holder plate *A*, Fig. 6, to which the upper binder ring *B* is attached, is fastened to the bottom surface of the hollow outer ram *C*. The plate may be as much as 9 inches thick, in the case of a large toggle press, to give the necessary strength to bridge over the hole in the outer ram through which the inner ram *E* operates. These blank-holder plates are reworked for use with another drawing die of equal or larger punch size when the original drawing die becomes obsolete. Occasionally a blank-holder plate is left permanently attached to the upper binder ring, but such a procedure is wasteful of storage space.

Usually the top of the punch *D* is made flush with the binder ring *B*. This requires that a punch riser or adapter *F* be attached to the punch, so as to extend above the blank-holder plate. If the outer ram of the press passes the inner ram at any time in its up stroke the distance that it passes must be added to the distance the punch adapter extends above the blank-holder plate.

The advantage of using a riser rather than building the punch itself up to the necessary height is that the size and weight of the punch casting are reduced, making it easier to handle during machining. Also, a double-action drawing die can be converted into a single-action die much more easily if the punch is flush with the binder ring. The conversion is effected by inverting the die, removing the punch adapter, and adding a bottom plate to which the punch is fastened and through which air pressure pins extend to operate the binder ring.

Such a conversion would be advantageous if it seemed when the die was tried out that, contrary to expectations, the air pressure was sufficient for the required binder action. In the case of dies used for limited production, a num-

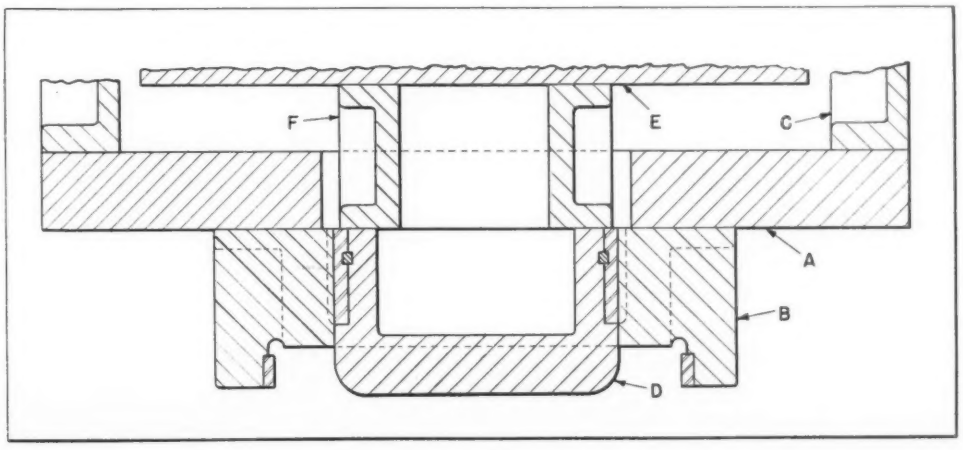


Fig. 6. Special Equipment is Required to Adapt a Double-action Drawing Die to a Toggle Press. This Includes Such Parts as a Blank-holder Plate A, which Holds the Upper Binder Ring B, and a Punch Adapter F which Reduces the Size and Weight of the Punch and Provides for Interchangeability of Dies on Different Presses

ber of standard risers, perhaps 6 inches square, can be attached temporarily to the top of the punch; these risers are easily removed from the punch when a drawing die is taken out of the press and bolted to the punch of the die that is to be substituted for another job.

Other pieces of press equipment are required, such as spacer plates and rings, for building up the height of the die when shut to the minimum height allowed by the press. Such spacer plates and rings are also used on crank presses of the larger sizes when the "shut" height of the press is in excess of that required by the die. These spacers or rings are used below the lower die or above the upper binder ring or above the punch adapter, depending on which will give the more desirable loading height. For most efficient operation, the loading height for a large part should be close to 40 inches. For very heavy parts, it is better to decrease that figure to 35 inches.

Trim Line Located in the Punch Area

It may not be possible to have the trim line in the binder surface, as shown in previous examples. In such a case, if the draw is difficult enough to require it, an air-operated toggle-action drawing die, with the part inverted, should be used as shown in Fig. 7. The part shown in the illustration has a rather sharp offset *A* in its flange at the rear side, which would not make a good binder surface. The trim line is indicated at *B;* the width of flange of the finished part lies between the trim line and the line *C*. The punch outline in the plan view *X* is extended outward at *D*, so that the trim line for a little more than the length of the flange offset is in the punch area. The punch has a step *E*, as shown in the section *B–B*, and the trim line is located on that step.

This condition makes the draw more difficult than if the part had no offset, since it is hard to prevent wrinkles even if the punch is extended to preserve a flatter binder surface. However, it would be even more difficult if the extra draw step were at the plan view corners of the punch. The more slanting the walls *F* of the offset, the easier will be the draw. The punch enlargement in the plan view is beveled at the ends *G*, so as to give a smoother contour to the drawing edges.

There are two reasons why the step *E* is necessary. If the binder surface followed the offset *A* in section *A–A*, it would be difficult for the metal to pull under tension across so irregular a surface. Also, the length of the blank in the binder surface, as measured in section *A–A*, would be greater than the corresponding length on the top of the punch, so that there would be excessive metal before the drawing action even started. If the end *F* of the offset *A* in section *A–A* were a very long taper or had a generous sweep at each end, the binder surface could follow the flange contour; then the punch would not have to be extended and the trim line would still be in the binder surface.

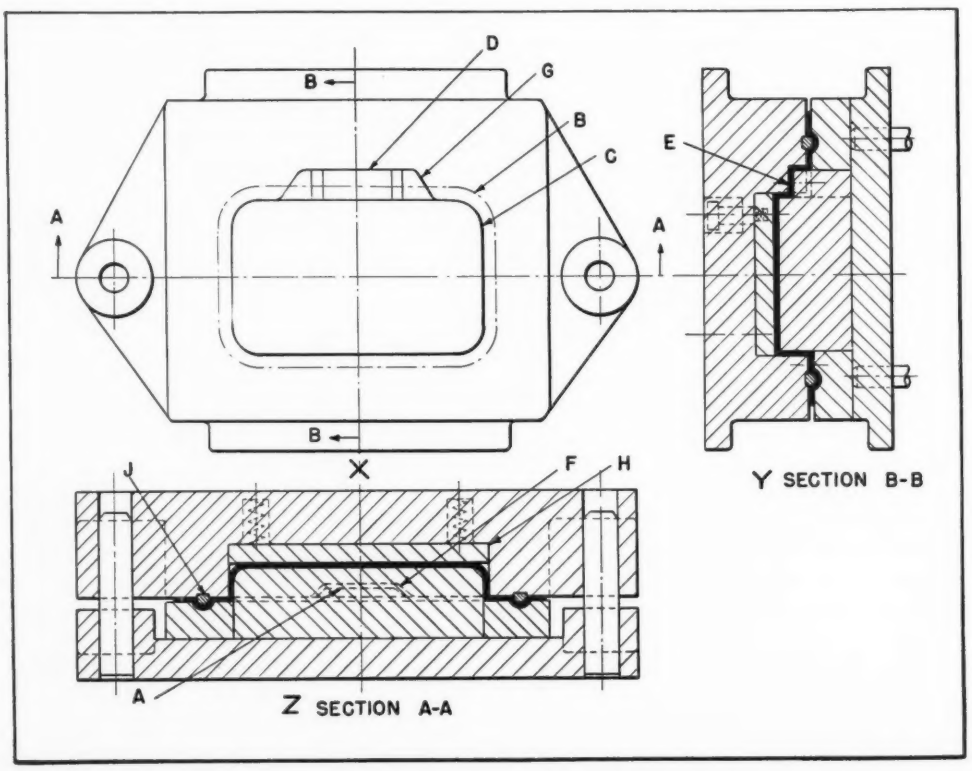


Fig. 7. The Trim Line B of the Metal Does Not Fall in the Binder Surface of This Air-operated Drawing Die since the Part has a Sharp Offset A. This Makes the Draw More Difficult, and in Some Cases May Require a Toggle-action Die

Tool Engineers Hear Plea for Industrial Peace

AT the banquet of the American Society of Tool Engineers, concluding the semi-annual conference, held at the Hotel Statler in Boston on November 1, Clayton R. Burt, chairman of the board, Niles-Bement-Pond Co., made a strong plea for industrial peace. Mr. Burt said, in part:

"If we are permitted to follow the pathways of peace, American equipment can do an unbelievable job in raising the standard of living, not only in the United States but throughout the world. The question is what paths are we going to be permitted to follow?

"Let's assume (and we all hope) that the future holds freedom from the ravages of war. If our efforts are devoted to producing the goods of peace, there is no limit to the wealth of development and the degree of living comfort we can attain. But—it can't be done unless management and labor get together and stop this crippling disease of strikes, slowdowns, and senseless bickering.

"Years ago a workman took pride in his work, and was determined to do every job the best he knew how. Yet in too many cases management has failed to recognize and encourage the individual worker, and has regarded him as a cog in the wheel. On the other hand, too many workers have failed to turn in an honest day's work, and yet expect top wages for only indifferent skill and loyalty.

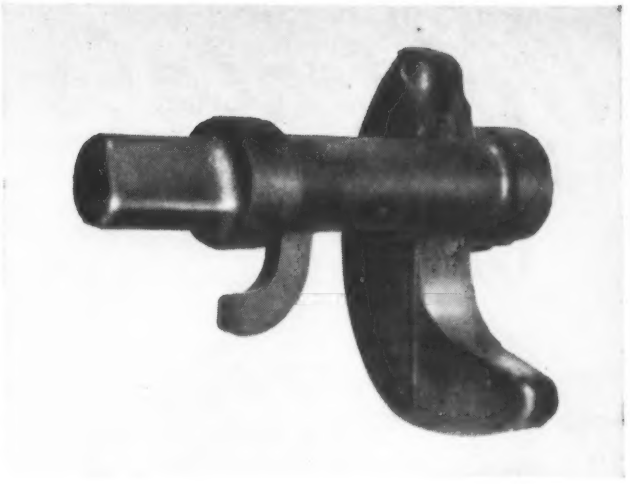
"The only way any of us can earn more is to produce more. Increased production is the answer to the big majority of our individual troubles, and certainly it is the only sure way to reduce the high cost of living. Planned economy will not work. We have witnessed many such attempts that have failed dismally.

"It is human relationships that make the wheels of production turn, and both management and labor must recognize each other's interests on a mutual basis."

* * *

Industrial Exhibit Portrays Fifty Years of Automobile Manufacture

A dramatic industrial exhibit, designed and built by the General Motors Corporation to portray fifty years of automobile development, has been opened at the Chicago Museum of Science and Industry. The exhibit occupies more than 10,000 square feet of floor space, and comprises some 1100 lineal feet of displays.



Intricate Cam Forging Made from Steel Bars at the Rate of Eight per Minute

High-Speed Production of Cam Forgings

Production of the intricate cam forging shown in the accompanying illustration is accomplished at the rate of eight parts per minute actual forging time on a 2500-pound Ceco-Drop gravity hammer in the plant of the Cornell Forge Co., Chicago, Ill. These cams are forged from bars 5 feet long, weighing approximately 30 pounds. The bars are heated at one end to a temperature of approximately 2200 degrees F. in an oil-fired furnace. After being forged, the parts are trimmed in a Chambersburg trimming press to a finished weight of 1.85 pounds.

The rapid up stroke of the drop-hammer is achieved by air pressure at 100 pounds per square inch, supplied by an Ingersoll-Rand compressor unit. The speed of the up stroke permits more blows per minute, and allows the forging to be completed at a higher temperature.

The features that characterize this high-production forging equipment are increased rate of production and simplicity of the hammer construction, as well as greater safety of the operator, who achieves his production with less manual effort.

* * *

A.S.M.E. to Hold Special Materials-Handling Session

A special national session of the materials handling and management divisions of the American Society of Mechanical Engineers will be held in Cleveland on January 13 and 14, concurrently with the National Materials Handling Exposition scheduled to be held in the Public Auditorium on January 12 to 16.

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

New Matched Tool-Steel Set Simplifies Selection

To simplify the selection, heat-treatment, and use of tool steels, a new and improved set of matched tool steels has been developed by the Carpenter Steel Co., Reading, Pa.

Three air-hardening tool steels have been added for applications where minimum distortion in heat-treatment and the elimination of hardening hazards are essential. When extreme wear resistance and good toughness are needed, No. 610 (Air-Wear) is recommended. For jobs where an ideal combination of wear resistance and toughness is essential, toolmakers can use No. 484 (Air-Hard). Vega (Air-Tough) is intended for tools that require extreme toughness with good wear resistance.

Two new steels also have been added to the Red-Hard matched set. T-K (Red-Hard) combines greater hardness with improved toughness, insuring more universal application. No. 883 (Red-Tough) offers extreme toughness and greater red-hardness, so that it can be applied to a wider field of uses. 201

A 650-pound, 8-foot Diameter Ring Produced by the General Electric Co. for the University of California's New Atom Smasher. Together with Nine Additional Plastics Parts, These Rings will Form the Vacuum Chamber of the Synchrotron

Improved Oxide Coloring Process for Steel Parts

A new oxide coloring process for treating all types of steels has been announced by Protective Coatings, Inc., Detroit, Mich. This process, known as "Blu-Blak," was developed originally as a gun-bluing method for the firearms industry, and has been successfully used in this field. All steels, including casehardened and cyanide-hardened parts, are colored to a deep blue-black at temperatures in the 250 to 295 degrees F. range after immersion in the process bath for fifteen to sixty minutes. Uniform coloring is readily obtained. In contrast to the usual coloring action, "Blu-Blak" penetrates to a maximum depth of 0.0001 to 0.0004 inch, as determined by the hardness of the steel, and then colors from the inside out. The processing bath can be used indefinitely without formation of sludge....202

Plastic-Bonded Rod for Hard-Facing with Colmonoy

Wall Colmonoy Corporation, Detroit, Mich., has recently placed on the market Colmonoy plastic-bonded rod for use in wire-metallizing equipment that will handle wires 1/8 and 3/16 inch in diameter.

Colmonoy plastic-bonded rod is composed of powdered Colmonoy No. 6, combined with a plastic binder and extruded to the sizes mentioned. As this rod passes through the flame of the metallizing gun, the plastic burns out, leaving the Colmonoy particles, which are deposited on the surface being sprayed.

After the desired amount of overlay has been applied (from 0.010 to 0.125 inch), the Colmonoy is bonded to the base metal by means of a large oxy-acetylene torch, induction equipment, or a

controlled-atmosphere furnace. With any of these methods, the result is a molecular bond between the Colmonoy and the base metal, identical to that obtained when the same alloy is applied in rod form. 203

Inorganic Cleaner Useful for General-Purpose Cleaning

A general-purpose inorganic cleaner, designed for maintenance work, but suitable for numerous other uses, is a new product of the Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa. The new cleaner, designated "Pennsalt MC-1," is a dry, granular material that dissolves quickly in water, removes most types of dirt easily, and rinses rapidly. Its applications include cleaning walls, floors, woodwork, and windows; industrial washing machine use; dishwashing in industrial cafeterias; and other general cleaning in factories, hotels, office buildings, and institutions. It is also applicable for steam-gun cleaning of painted or unpainted surfaces and for tumble-barrel cleaning, burnishing, and deburring operations. 204

Sintered Alloy Developed for Highly Stressed Parts

P. R. Mallory & Co., Inc., Indianapolis, Ind., has developed a sintered alloy known as "Mallory 1000 Metal," which has great strength and a high density approaching that of tungsten. It is being widely applied as balancing components in rotors for such devices as gyro-pilots and governors. Its high modulus of elasticity—from 20,000,000 to 40,000,000 pounds per square inch—combined with its high density and tensile strength, makes it an excellent material for highly stressed parts. It is also useful in both industrial and medical fields for radium containers, as its density furnishes excellent protection against gamma radiation. Unlike tungsten, Mallory 1000 Metal is readily machinable. Its resistance to atmospheric corrosion and to certain acids makes it useful for fixtures employed in electrolytic processes. 205

Color Anodizing of Aluminum Die-Castings Made Easier

Aluminum die-castings, especially those containing substantial amounts of silicon, which have been difficult to anodize and color can now be treated by the use of special anodizing solutions, equipment, and techniques developed by the Colonial Alloys Co., Philadelphia, Pa.

The colors produced are lustrous and bright, but not so vivid as those produced in the color-anodizing of wrought aluminum. The surfaces are characterized by a glazed effect in the high-silicon type alloys, and smooth, solid, deep colors in many of the silicon-free types of alloys.

Besides improved appearance, this method of color-anodizing provides high corrosion resistance (250-hour minimum salt spray test in accordance with Government Specification ANQQA696a), abrasion resistance, and electrical insulation. The anodized coating serves as an excellent base for paint. Anodized aluminum coatings, unlike platings, are part of the base metal, and are not subject to peeling or blistering. Except for some changes in color, high temperatures have little or no effect on them. 206

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on these pages, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in December, 1947, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on the blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

NAME.....POSITION OR TITLE.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM.....

BUSINESS ADDRESS.....

CITY.....STATE.....

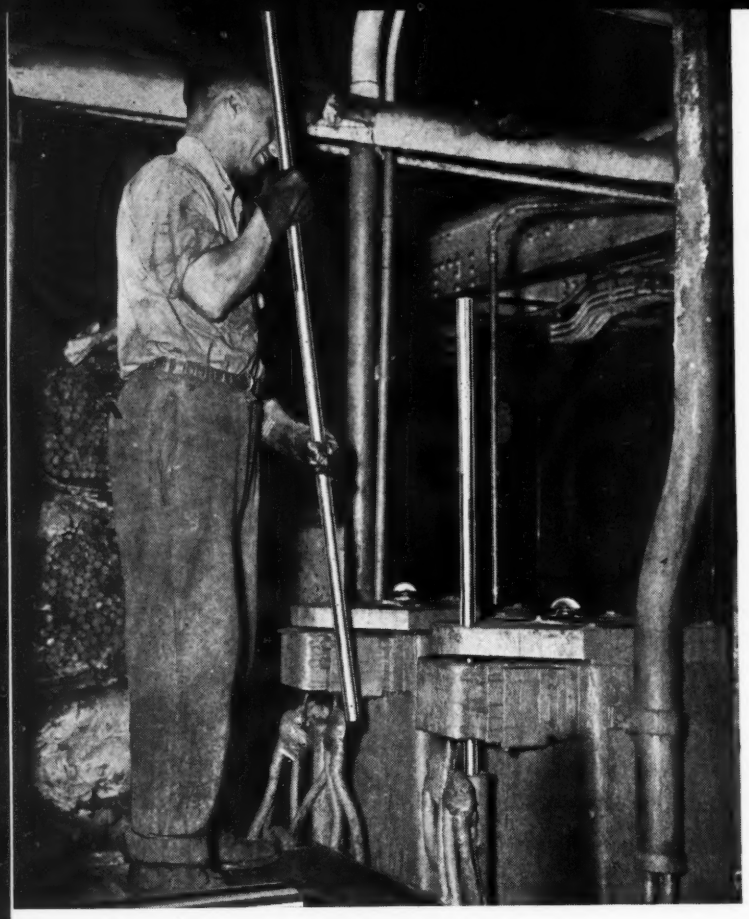


Fig. 1. (Above) Automobile Drive-shafts are Spot-hardened on Two Bearing Areas by the Use of a Ford-developed Manual Induction Heating Unit

Induction Hardening of Drive-Shafts with Simple Equipment

High-production automatically loaded and unloaded equipment employed by the Ford Motor Co. for the induction hardening of starter ring gears was described in an article published in November, 1946, MACHINERY. Induction hardening equipment, however, need not be mechanized in order to be economical. This is indicated by Fig. 1, which shows Ford-developed manual induction equipment designed for the spot-hardening of Lincoln drive-shafts. Two bearing surfaces, one near the center of the shaft and the other at the front end, are hardened with this equipment for a length of 1 3/4 inches on a diameter of 1 1/8 inches.

The drive-shafts are placed upright in a fixture provided with heating coils that surround the shaft at the sections to be hardened. When these sections have been heated to 1500 degrees F., which occurs within ten seconds, the shafts are withdrawn from the fixture and immediately quenched in a deep tank of caustic soda solution, which is illustrated in Fig. 2. The hardness of the bearing surfaces at the end of the operation is 50 Rockwell C. Caustic soda solution is used instead of water because of its greater heat-conducting properties, resulting in a somewhat more drastic hardening effect.

* * *

Report on the Metal Trades Industry

The International Labor Office has just brought out comprehensive reports on the world's metal trades industry, which embrace a study of the industry's employment and production problems in a number of countries, a survey of labor-management relations, and a study of wage systems. These reports cover the first two sessions of the International Labor Office's metal trades committee, which is composed of government, management, and labor representatives from seventeen countries. The first session was held in Toledo, Ohio, last year, and the second in Stockholm, Sweden, this year.

The reports are published in five volumes, the total cost of which is $2.75. Those interested can obtain further information by communicating with the International Labor Office, 734 Jackson Place, Washington 6, D. C.

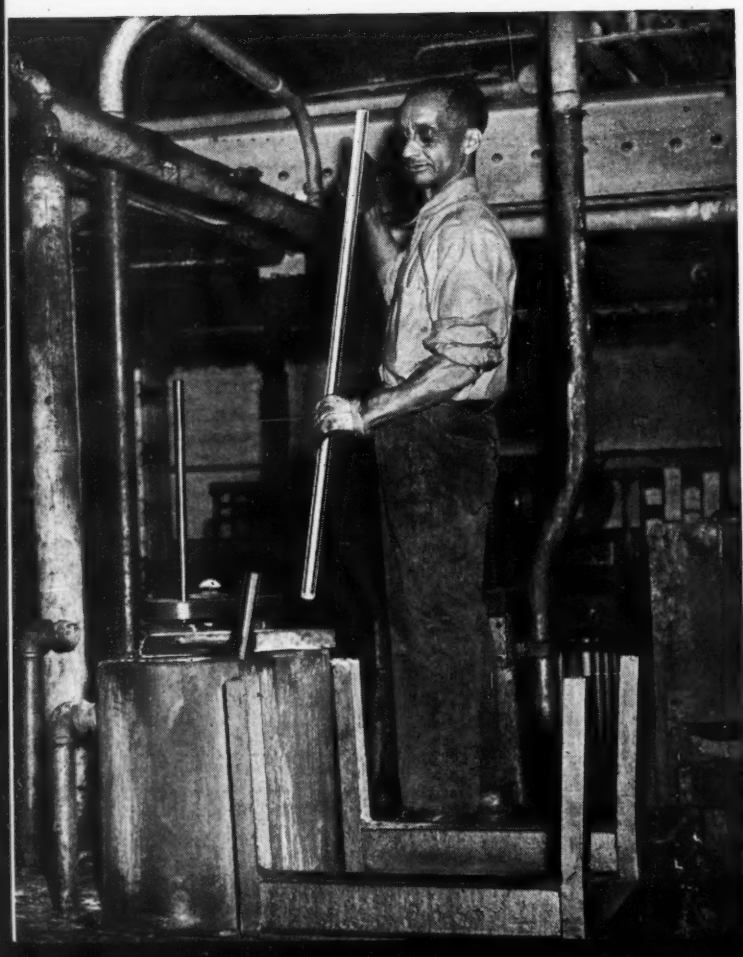
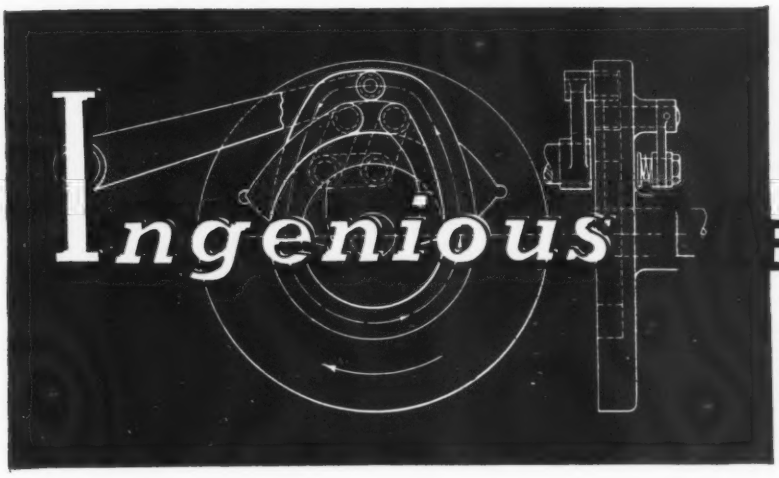


Fig. 2. (Left) When the Drive-shafts have been Raised to a Temperature of 1500 Degrees F. at the Two Points to be Hardened, They are Immediately Immersed in a Tank of Caustic Soda Solution



Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Quick-Acting Intermittent Feeding Mechanism

By F. SERVER

The feeding mechanism shown in the accompanying illustrations was designed for winding paper intermittently on an automatic machine. In this mechanism, advantage is taken of the toggle joint locking principle for quickly applying and securely holding a split nut in contact with the lead-screw.

The design of the machine necessitated placing the camshaft *A*, Fig. 1, at a considerable distance from the lead-screw *B*. The two halves *C* and *D* of the split nut are shown in Fig. 1 disengaged from the lead-screw, so that the mechanism to which they are attached will not be moved transversely by the lead-screw. In Fig. 2, the split nut is engaged with the lead-screw, and the mechanism carried on bracket *O* has been fed about 2 inches. Intermittent feed is accomplished by bringing together and separating the two halves of the nut at predetermined intervals in the operating cycle of the machine.

The upper ends of arms *J* and *K* engage slots in the sides of the split-nut halves. These arms

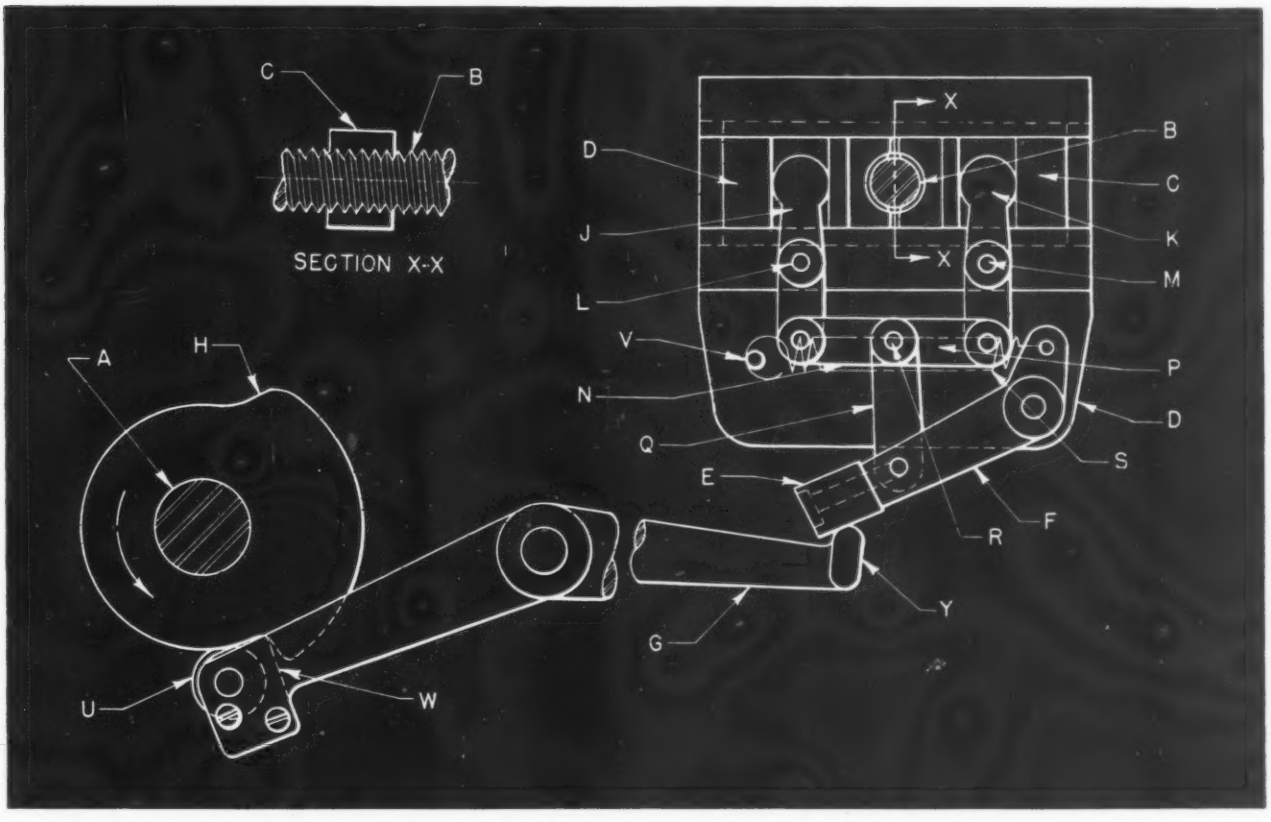


Fig. 1. Cam H, Bellcrank G, Rocker Arm F, and a Toggle Joint Provide Intermittent Feed by Periodically Engaging and Disengaging Lead-screw B and Split Nut C and D

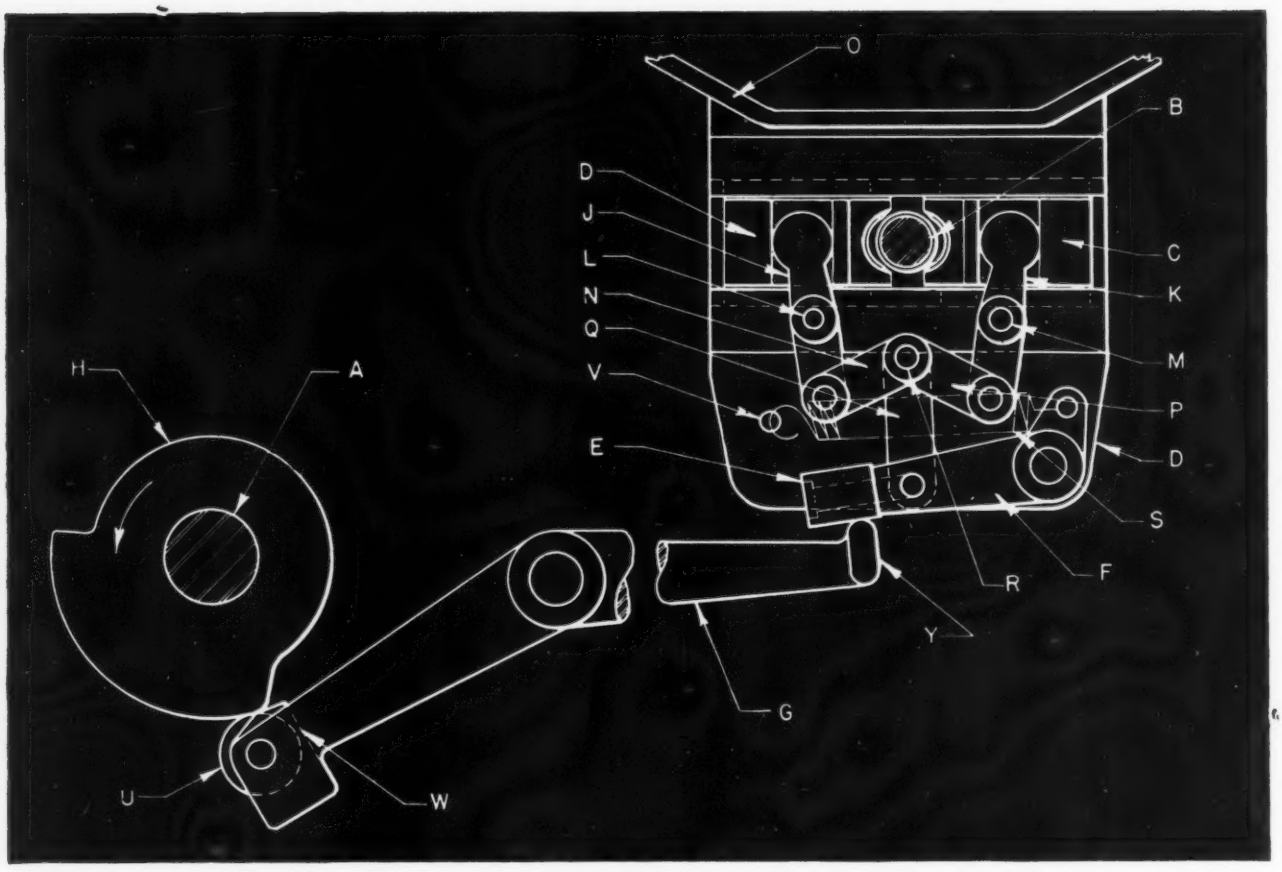


Fig. 2. Closed or Feeding Position of the Mechanism Shown in Fig. 1. In This View, the Split Nut has been Brought into Engagement with the Lead-screw to Feed the Mechanism

pivot about studs *L* and *M*, and their lower ends are joined to a stud *R* by links *N* and *P*. Link *Q* connects this toggle joint to rocker arm *F*.

Roller *E*, at the lower end of the rocker arm, engages extension pad *Y* on the longer arm of bellcrank *G*. The bellcrank is pivoted by roller *U* or block *W* coming in contact with cam *H*, which rotates with shaft *A* in the direction indicated by the arrow.

The function of block *W* is to prolong the period during which the lever holds the split nut in its open position after the roller leaves the rise on the cam. The shape of the block provides a fast drop-off at the end of the "open" travel, as indicated in Fig. 2, and permits the split nut to snap quickly into engagement with the lead-screw. Spring *S*, which is attached to the upper end of rocker arm *F* and is hooked over pin *V*, exerts sufficient tension to hold the roller and block in contact with the cam, and also locks the toggle joint in either the open or closed position.

* * *

The gearing industry, as reported by the American Gear Manufacturers Association, showed an increase in volume of sales for September, compared with August, of 18 per cent.

Apprenticeships Should be Expanded to Supply Skilled Labor

It is of vital importance to our national economy and to our national safety that we expand apprenticeship in the tool- and die-making trades and other skilled trades, according to William F. Patterson, Director, Apprentice-Training Service, U. S. Department of Labor, who recently spoke at the annual convention of the National Tool and Die Manufacturers' Association. Mr. Patterson pointed out that few apprentices were trained during the depression and war years. As a result, the average age of skilled workers has increased, and there already is a shortage of craftsmen in some trades and in certain areas.

* * *

In constructing a die set, contour sawing of the mating punch and die from a single piece of steel in one operation eliminates the old "blacksmith" method of center-punching, drilling a row of holes, hammering out the slug, chiseling, and filing. Machining strains that cause dies to crack are not produced by this method of manufacture, as strains inherent in the metal are released by contour sawing.

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Fly Cutter of Wide Range

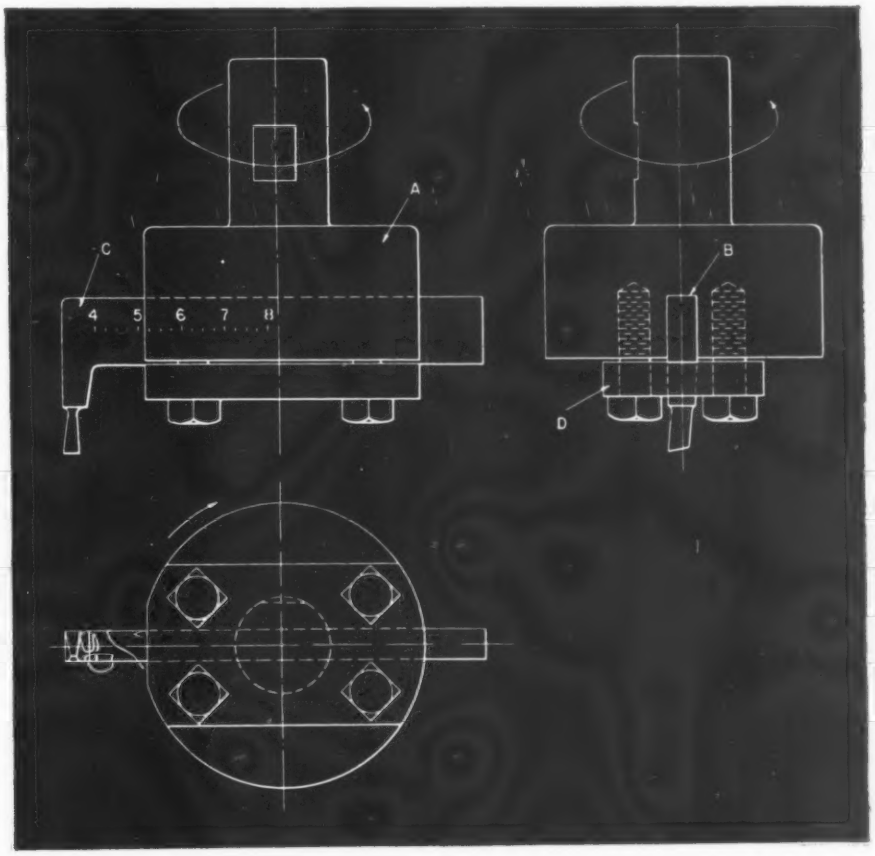
By ROBERT MAWSON, Providence, R. I.

A small jobbing machine shop is called upon to make or repair parts for anything from a simple farm implement to a complicated machine tool. As a result, the equipment must be adapted to meet day-to-day requirements.

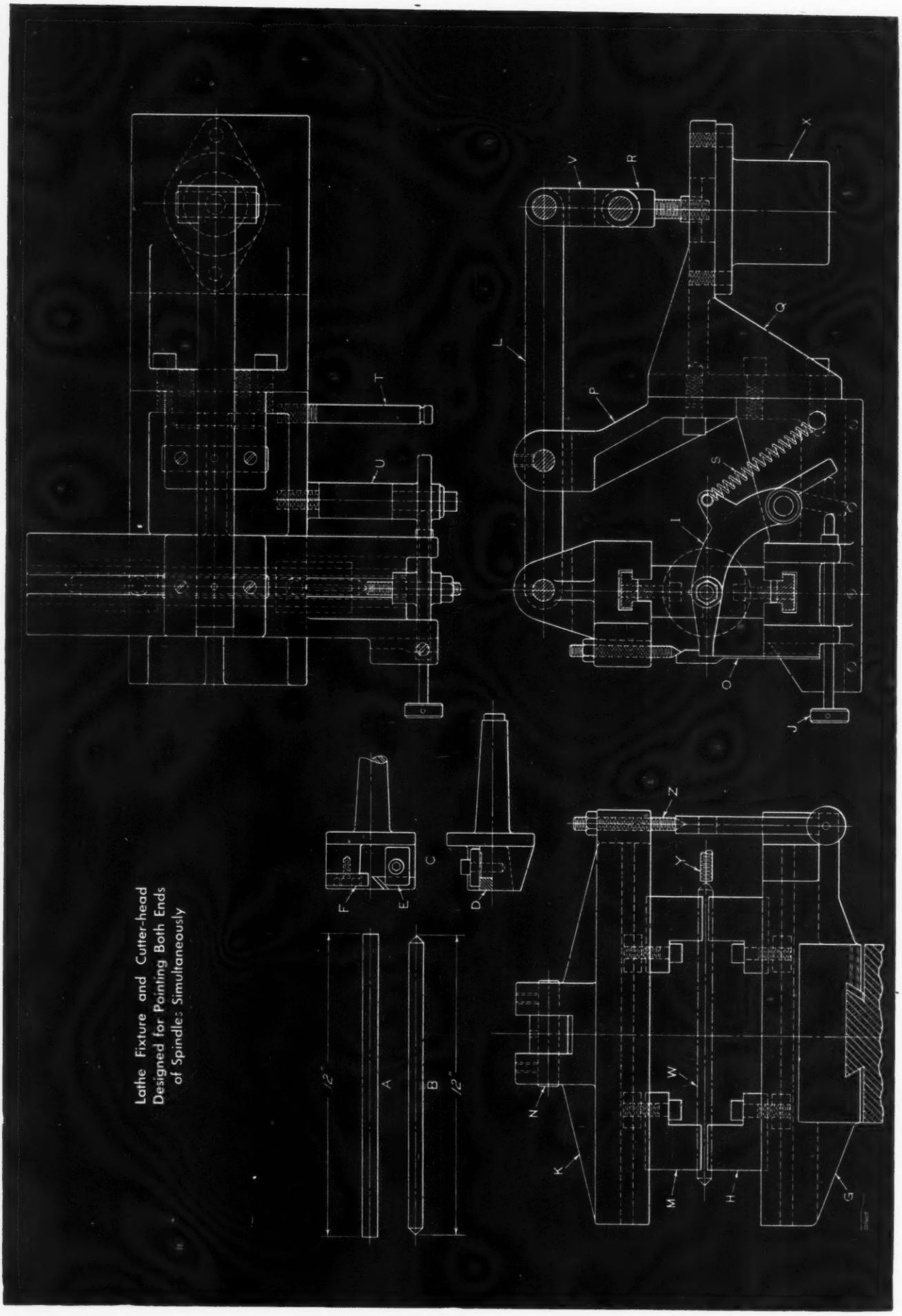
A typical job handled in a small shop was the cutting of a number of holes at various locations in 1/4-inch steel plate. These holes were of five different sizes ranging from 4 to 8 inches in diameter. To do the job without incurring prohibitive tooling costs, an adjustable fly cutter was designed, as shown in the accompanying illustration.

The body *A* of the cutter is made of machine steel and finished all over. A slot *B*, 5/16 inch wide, is cut in the body, and the high-speed steel cutting tool *C* is made a good sliding fit in the slot. This tool projects slightly below the lower edge of the cutter body. A clamp *D*, fitted with four screws that are tapped into the head of the cutter, holds the cutting tool securely in position. Graduations are marked on the edge of the tool for adjusting it to the desired diameter, the index point for the graduations being on a cut-away portion of the body.

To perform the machining operation, the operator lays out the positions on the steel plate, adjusts the tool to the correct diameter, places it in the spindle of a vertical drill press, and cuts the hole. The use of this adjustable fly cutter resulted in a satisfactory machining job, with a minimum tooling cost.



Adjustable Fly Cutter Used to Cut Holes Ranging from 4 to 8 Inches at Various Locations in 1/4-inch Steel Plate


Lathe Fixture and Cutter-head
Designed for Pointing Both Ends
of Spindles Simultaneously
12"
A
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12"
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Lathe Fixture for Pointing Spindles

By HAROLD E. MURPHEY, Westerly, R. I.

The fixture shown in the accompanying illustration was designed for use in machining conical points on cylindrical spindles *A*, as indicated at *B*. The pieces thus pointed are known as "spindle blades." This operation was formerly performed in a turret lathe in two steps, the work being turned end for end in the chuck or collet for pointing both ends.

In order to speed up production on this job, an old engine lathe was equipped to perform both pointing operations in one setting of the work. The original headstock and a second headstock taken from another lathe of the same make and size were employed. The second headstock was substituted for the footstock of the lathe, thus equipping the machine with two opposed headstocks. Each headstock was driven separately from a countershaft having two driving cones.

A cutter-head *C* was mounted in each headstock spindle. These cutter-heads carried a pointing blade *D*, which was held in place by a clamp *E*. A follow-rest *F*, having a V-shaped groove cut in its end to support the work, was also inserted in the cutter-head. The clamp *E* and the follow-rest were held by Allen cap-screws.

The details of the fixture are shown in the three views of the illustration. The lower member *G* fits the carriage of the lathe, and after being located in the right position in relation to the center of the lathe spindle, is clamped with a gib and four gib screws. Member *G* has a T-slot cut its entire length to accommodate the lower clamping blocks *H*, which can be adjusted in the T-slot to suit different lengths of work. These clamping blocks are held in position by cap-screws. Member *G* also carries the stop-lever *I* and reset pin *J*.

The top member *K* is mounted loosely on the toggle-bar *L* to allow it to centralize itself on the work shown by the dot-and-dash lines at *W*. Member *K* also has a T-slot cut its entire length for mounting the upper clamping blocks *M*, which are adjustable in the T-slot to suit work of different lengths. These clamping blocks are also held in position by cap-screws. The pin *N* which holds member *K* to the toggle-bar *L* is held in place by two headless screws. Member *K* also carries a pointed set-screw *Z* for tripping the hardened and spring-tempered latch *O* fastened to member *G*.

Work stop-lever *I* with adjustable stop-screw *Y* is shown in the loading position, where it locates each piece of work in the same identical position. The bracket *P* carries the pivoting point stud for the toggle-bar *L*. The bracket *Q* carries the air cylinder *X*, which operates the toggle-bar *L*, pivoting it on the pin in bracket *P* to raise and lower the top member *K*. Stud *R* is screwed into the air-cylinder piston, and is moved in or out by the 1-inch piston stroke.

In the view at the lower right-hand corner, the top member *K* is shown about to clamp the work, and the pointed screw *Z* is in position to push the trip-latch *O* away from the stop-lever *I*. The tripping of latch *O* permits the tension spring *S* attached to stud *T* to pull the stop-lever back against the end of the reset pin *J*, allowing room for the cutting head to move inward and point the work.

One end of the stop-lever stud *U* is threaded and screwed into the lower member *G*, while the other end is provided with a running-fit bearing for the stop-lever to swing on and a threaded outer end for a retaining nut and washer. The toggle-block *V* is slotted at both ends to receive toggle-bar *L* and stud *R*. The main air line is connected to the air cylinder, which exerts a pressure of 80 pounds on the 2 to 1 ratio toggle arrangement, thus producing a work-clamping pressure of 160 pounds. The opening and closing of the clamping members are regulated by a hand-operated air control valve on the machine.

Operation of the fixture is as follows: With the air shut off so that the piston in the air cylinder is in the back stroke position, top member *K* raised, and stop-lever *I* in the position shown, a piece of work is placed in the lower blocks *H* with one end against the stud *Y* of stop-lever *I*. Air is then admitted to the cylinder, causing the blocks *M* secured to top member *K* to clamp the work securely in place. As top member *K* moves downward, it automatically brings the pointed screw *Z* down on the trip-latch *O*, which releases stop-lever *I*, thus allowing clearance for the cutter-head mounted in the spindle of the right-hand headstock.

Now with the work clamped rigidly between blocks *H* and *M*, the lathe carriage is run to the right or left until it reaches a stop on the lathe bed. This brings the work into contact with one of the cutter-heads which points one end of the work. The carriage is then fed in the opposite direction for pointing the other end.

The air pressure is next released to allow the top member *K* to rise and clear the work. The work is then removed from the fixture and the same procedure repeated with the succeeding piece. By replacing the regular carriage operating handwheel of the lathe with a four-spoke wheel from a turret lathe, the carriage can be operated back and forth at a considerable saving in time.

Machine Tool Builders Recommend Tax Revision at Annual Meeting

AN eight-point program of federal tax revision was recommended by the National Machine Tool Builders' Association at its forty-sixth annual meeting, which was held at Hot Springs, Va., on November 17 and 18. The eight points of this program, proposed by F. S. Blackall, Jr., president of the Taft-Peirce Mfg. Co., Woonsocket, R. I., and chairman of the Association's committee on fiscal problems, are as follows:

1. Liberalization of depreciation allowances to permit the taxpayer to establish his own rates, provided he follows them consistently. The depreciation in any year is to be taken only to the extent that it results in a tax saving.

2. Either the outright repeal of Section 102, which provides for a penalty tax on "unreasonable accumulation of surplus," or else its modification to apply only to cases of deliberate tax evasion. The penalty tax to be levied only upon that portion of the surplus which is determined to be unreasonable and the burden of proof, in any event, to be upon the Treasury Department.

3. A three-year carry-back and a six-year carry-forward.

4. Modification of existing surtax rates to provide for an immediate ceiling of 60 per cent and an ultimate ceiling of 50 per cent.

5. Reduction in the capital gains tax and full recognition of capital losses for tax purposes.

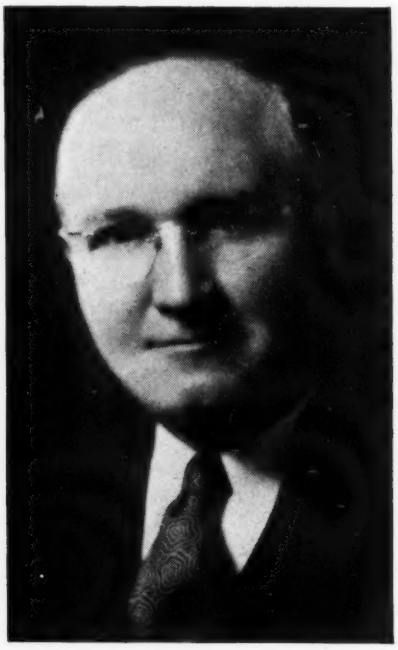
6. Elimination of the double taxation of corporate dividends.

7. Extension of the community property principle of federal income taxation to the people of all of the states.

8. Elimination from the gross valuation of a decedent's estate of insurance carried by the decedent, at least to the extent of the amount of tax payable.

Mr. Blackall emphasized that if America is to remain a land of opportunity, men of ambition and enterprise must be able to go into business, form companies which grow progressively larger, and in due course employ more men. In past years, this has been the way in which America has progressed. "Our present federal tax laws," he said, "must be amended to provide reasonable incentives for taking business risks. This nation should be full of new small businesses, competing and striving to grow larger, as used to be the case. But under our tax laws today, business success is penalized rather than rewarded. Not

Alexander G. Bryant, New President of the Machine Tool Builders' Association



Lloyd D. McDonald, First Vice-president of the Machine Tool Builders' Association

Photo Whitney

David Ayr, Newly Elected Second Vice-president and a Director of the Association

until federal tax laws are changed can we regain that normal interplay of competition and opportunity which is so vital to our industrial economy."

Production requirements on behalf of both world reconstruction and our domestic economy, plus considerations of our own national defense, were stressed by the retiring president of the Association, Herbert H. Pease, president of the New Britain Machine Co. To make possible the turning out of large quantities of the most modern machine tools, Mr. Pease made the following three-point recommendation:

1. A change in the depreciation policy of the Treasury Department with respect to machine tools.

2. A change in our basic tax laws that will permit companies to plow back more earnings into re-equipment without being penalized for doing so.

3. An aggressive sales policy on the part of the machine tool industry to prove to customers that new machine tools today must be considered not solely in the light of their cost, but in the light of their performance in reducing operating costs.

Other papers presented at the meeting were: "Foundation for Sales," by Swan E. Bergstrom, vice-president of Cincinnati Milling and Grinding Machines, Inc.; "Building Sales Abroad," by Alexander S. Keller, vice-president of Pratt & Whitney; "Building Sales at Home," by Herbert L. Tigges, vice-president of Baker Brothers, Inc.; "Momentum in Public Relations," by William L. Dolle, president of the Lodge & Shipley Co.; and "Arsenal for the Future," by James Y. Scott, president of the Van Norman Co.

The speaker at the annual dinner was Ernest K. Lindley, Chief of the Washington Bureau of *Newsweek*, whose subject was "The World Looks to Washington."

Alexander G. Bryant, vice-president of the Cleereman Machine Tool Co. of Chicago, Ill., and Green Bay, Wis., and president of the Bryant Machinery & Engineering Co., Chicago, was elected president of the Association for the coming year. During the war, Mr. Bryant was chairman of the Association's Government Relations Committee. He also served on the Advisory Committee of the War Production Board, was advisor to Will Clayton, then Director of Surplus Property Disposal, and was consultant to the Reconstruction Finance Corporation on machine tool policies.

The first vice-president will be Lloyd D. McDonald, vice-president of the Warner & Swasey Co., Cleveland, Ohio, and the second vice-president, David Ayr, president of the Hendey Machine Co., Torrington, Conn. Louis Polk, president of the Sheffield Corporation, Dayton, Ohio, was re-elected treasurer; Frida F. Selbert was re-elected secretary; and Tell Berna was re-appointed general manager. New directors elected were David Ayr; Harold B. Smith, president of the Illinois Tool Works, Chicago, Ill.; and M. A. Hollengreen, executive vice-president and general manager of the Landis Tool Co., Waynesboro, Pa.

* * *

High-Speed Camera Shows Quenching Action of Water on Steel

High-speed cameras, which are finding increasing applications in the study of many different types of industrial phenomena, recently were put to work by engineers of the United States Steel Corporation of Delaware at the Research Laboratory in Kearny, N. J. There the cameras are being used to observe the actions of air, oil, water, brine, and other quenching media on white-hot steel bars—actions that are too fast to see with the naked eye but that are readily "stopped" by exposures of 1/10,000 second. The accompanying illustration shows a typical water quenching operation photographed by a high-speed camera. The camera shows that as the bar is dropped into the quenching tank, a pocket of water vapor is formed; almost instantly, the vapor escapes, and subsequent contact with the water quickly cools the bar. This action is so rapid that it cannot be detected by the naked eye.

Photograph Taken with a High-speed Camera, Showing the Pocket of Vapor Formed when the Steel Bar is Quenched in Water

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Cutting Small Tubes without Burring the Edge

G. S. L.—I would like to get suggestions on a method for cutting off tubing of 1/8 inch diameter and 1/16 inch bore. The use of a conventional circular saw or abrasive wheel produces a burr and deforms the tube.

A.—Many shops are cutting tubing with high-speed steel saws and are not experiencing trouble with burring or deforming of the work, but adequate support is necessary adjacent to the cut and the saw must be removed at the slightest sign of dullness. One job handled in this way involved cutting brass and copper tubing 5/16 inch and 1/4 inch in diameter and about 0.015 inch thick. The high-speed steel saw used was 3 1/2 inches in diameter, 1/64 inch thick, and had a 1/32-inch pitch. It was mounted directly on the shaft of a 1/4-H.P. motor operating at 1200 R.P.M.

A small fixture with a slot slightly deeper than the maximum diameter of tubing to be cut and 3/32 inch wide was mounted on a swinging arm and equipped with a supporting block to take the thrust of the saw. A stop-block was used to measure off the work. With this arrangement, the tubing was cut at the rate of over 1000 pieces per hour, with no burring or deformation.

Complaints about Unsatisfactory Machines

P. F.—How soon after a manufacturer delivers a machine is it necessary to make a complaint if it is not satisfactory? If the manufacturer has given a written guarantee, must a complaint be entered at once, or can it be entered at any time?

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

According to recent higher court decisions, all purchasers who rely upon an "expressed" or written guarantee must promptly and without "unreasonable" delay register a complaint regarding alleged defects or poor quality of the purchased equipment. A case in point is that of James v. International Harvester Co. [172 S.W. (2d) 671], in which the higher court said:

"A buyer, after discovering defects in a machine, must elect to take action promptly after discovering the defect, and unless prevented by the seller from doing so, offer to restore the property and rescind the contract. Even this right is lost if the warranty relied on is an express warranty, and the specified conditions upon which the warranty is made available to the purchaser are not complied with."

The legal effect of this decision means that if a seller gives an expressed guarantee regarding his product, the purchaser must promptly report to the seller any complaints. Failure to do so may result in the purchaser not receiving a favorable verdict in a later suit. If the equipment is not warranted by an expressed guarantee, but the seller knows the uses to which it is to be put by the purchaser, an implied guarantee exists. However, in either event the purchaser must promptly complain of what he believes to be a breach of the guarantee.

Corrosion-Resistant Metal

C. A.—What material would be best suited for strainers handling a solution of 75 per cent salt and 25 per cent sulphur?

Answered by Editor of "Nickelsworth"
Published by the International Nickel Co., Inc.

For handling a solution containing 25 per cent sulphur and 75 per cent salt brine, Monel metal should be satisfactory. It is resistant to corrosion by salt brine solutions in all concentrations, and resists corrosion by sulphur where it is present at moderate temperatures. Monel metal is liable to tarnish in the presence of sulphur, although the tarnish film formed tightly adheres to the metal and is of minute thickness.

Its resistance to corrosion by the salt brine, of which this solution is principally composed, is superior to that of other metals and alloys available in wire cloth form. Inconel and stainless steel alloys would be more resistant to tarnishing from the effect of the sulphur which the solution contains, but would be inferior to Monel metal in the more important property of resistance to corrosion by the salt brine.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Cincinnati Die Milling and Multiple-Unit Production Milling Machines

The Cincinnati Milling Machine Co., Cincinnati 9, Ohio, has announced a new 8- by 18-inch tool and die milling machine, shown in Fig. 1, and a unit type production milling machine, shown in Fig. 2. The tool and die milling machine has been designed for the rapid, economical production of plastic molds, permanent molds, metal patterns, die-casting dies, small drop-forging dies, and other types of work requiring the production of accurately shaped contours.

The sensitive hydraulic tracer mechanism of this machine provides for automatic duplication of intricate shapes with a high degree of accuracy. Smooth, sensitive hand control of the table movements provides the delicate "feel" of the cutter action required for precision work. This feature also reduces operating effort to a minimum. Provision for excellent visibility of both work and model or templet as the work progresses is an important feature of the machine.

A wide range of secondary operations can be performed without removing the work to another machine by employing the slotting attachment. With this equipment, such operations as drilling, reaming, boring, angular cutting, and slotting can be performed quickly and accurately.

The spindle-carrier is mounted on a transversely adjustable ram, the rear portion of which has a mounting surface for the slotting attachment. The ram, in turn, is mounted on a swiveling turret which permits the slotting attachment to be swung instantly into position over the machine table. This attachment is mounted on a double swivel, and has its own individual motor drive.

A wide range of angular milling jobs is made possible by a unique, double-swivel arrangement of the spindle head, in which the head swings on segments of circles, the centers of which lie close to the tip of the cutter. Hence, the cutter remains close to the original position, even when swiveled to the maximum angular position. Ten spindle speeds are available ranging from 225 to 4000 R.P.M. The spindle is driven by a single V-belt, and speed changes are made by means of a two-speed motor and a pair of five-step sheaves.

The new No. 000-4 unit type

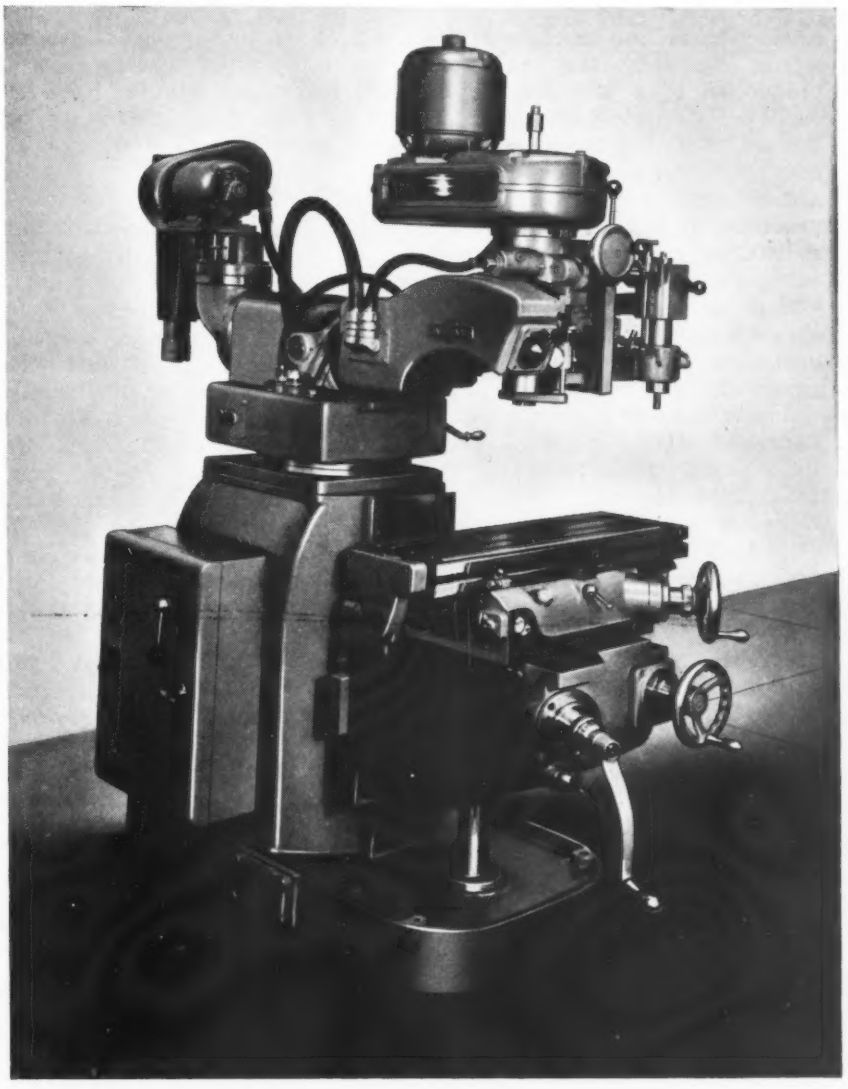


Fig. 1. Cincinnati Die Milling Machine Equipped with Sensitive Automatic Depth Control Tracer Mechanism

To obtain additional information on equipment described on this page, see lower part of page 226.

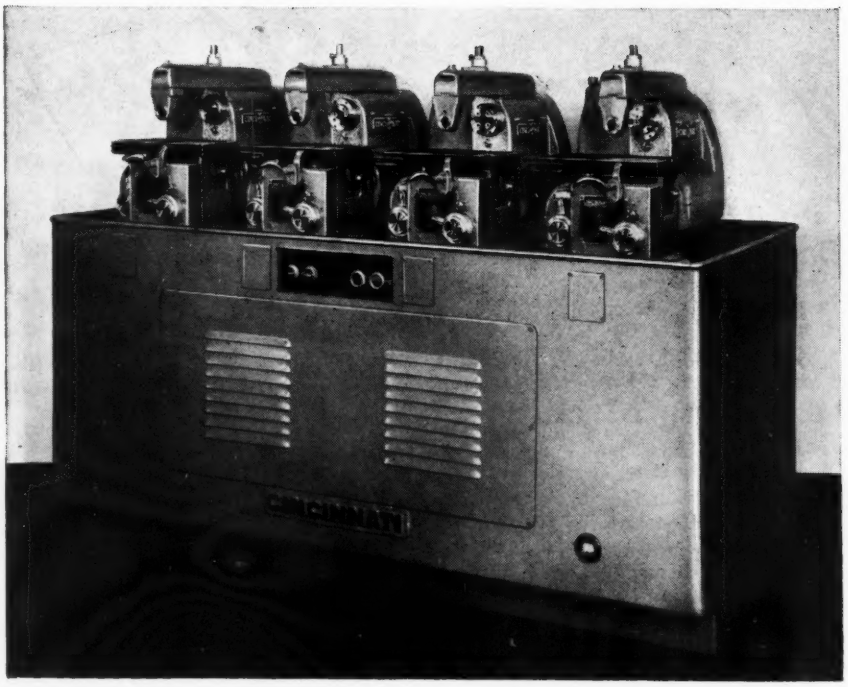


Fig. 2. Unit Type Production Milling Machine Brought out by the Cincinnati Milling Machine Co.

production milling machine is designed especially for the rapid production of a wide variety of small parts required in the manufacture of sewing machines, business machines, cash registers, firearms, small tools, and similar products. It is comprised of four individual milling machines of extremely small size, mounted together on a single base. With this arrangement, four separate operations can be performed progressively by the different units.

The machines are completely hydraulic, having piston and cylinder table feed and balanced axial type hydraulic motors for the spindle drives. Each machine is, in effect, a miniature fixed-bed manufacturing type milling machine. The table travel is 4 inches, and the vertical adjustment of the spindle-carrier is 3 inches, the distance between the top of the table and the center line of spindle ranging from 2 to 5 inches.

The spindle is ball-bearing mounted in a quill which provides for a 1/2-inch cross adjustment. The simple hydraulic circuit employed makes the feed and speed ranges extremely flexible. Standard ranges are from 1 inch to 40 inches per minute for the table feed, and from 500 to 1800 R.P.M. for the spindle speeds, although considerably lower or higher ranges can be supplied if desired. The table rapid traverse rate is 200 inches per minute. Feed and speed rates remain constant under all conditions, and are not affected by temperature or viscosity changes.

The table operating cycles are completely automatic. Dog control of the cycle permits the use of intermittent feed and rapid-traverse strokes if required. The table can be fed in either direction, and operation can be single-cycle or continuous-cycle as desired. The continuous cycle permits the use of magazine and hopper feeding devices. Climb cuts can be taken as easily as conventional cuts, since the short oil column in the table feed cylinder eliminates undesirable compressibility effects in the hydraulic oil system. The table trip from rapid traverse to feed can be held within several thousandths of an inch. The cycle control dogs are mounted on a removable dog rail which, in turn, can be mounted on the fixture to effect an important saving in set-up time when changing jobs. Any desired combination of cycles can be used on the separate machine units. The single, double, triple, and quadruple unit machines occupy a floor space of 32 by 30, 42 by 30, 61 1/2 by 30, and 81 by 30 inches, respectively, and weigh 860, 1525, 2185, and 2650 pounds. 71

Gorton Three-Dimensional Pantograph Machine with "Ratiobar" Tracer Control

A small-size three-dimensional pantograph machine designed for light milling of intricate dies, hobs, molds, stamps, and similar work is a recent product of the George Gorton Machine Co., Racine, Wis. A "Ratiobar" tracer control, for which patents have been applied, is an outstanding feature of this new machine. In size, work-holding capacity, and metal-removing ability, the new machine is comparable to the Gorton 3-U two-dimensional pantograph, and it also incorporates the same reduction ratios, except the 1 to 1 ratio.

The "Ratiobar," supported at each end by the precision balanced over-arm, aligns the pivot center, cutter-spindle, and tracing stylus, and thus simplifies accurate ratio adjustment for all pantograph settings. With the new "Ratiobar" design, there is only one slider block to adjust for whatever reduction ratio is desired, a feature which greatly reduces the chance for errors.

The "Ratiobar" is a rugged, horizontally pivoted aluminum casting on which two hardened and ground steel tracks are mounted. The tracer stylus and cutter-spindle float on precision ball bearings which travel in these tracks. This construction is extremely sensitive, and yet rigid. Another advantage of the "Ratiobar" is that it carries the weight of the entire pantograph mechanism, thus relieving the linkage members of this weight. The new design also has the advantage that as the tracer moves away from the pivot center, the pantograph linkages move toward it, thereby maintaining a better balance.

The new machine is said to be exceptionally sensitive and accurate. The surface of an enlarged master or pattern mounted on the copy table is traced in three dimensions manually with the stylus while the cutter reproduces on the work-piece all the angles, curves, and surfaces of the master at the desired reduction ratio.

To obtain additional information on equipment described on this page, see lower part of page 226.

The machine can also be easily adapted for general two-dimensional light milling and engraving operations. When used with the Gorton roll attachment, light milling and engraving can be done on cylinders, rolls, tubes, dials, or any peripheral surface. Ratios ranging from 2 to 1 up to 40 to 1 are obtainable. The pantograph bar is graduated for reductions of 1 to 2, 1 to 3, 1 to 4, 1 to 6, 1 to 8, 1 to 12, and 1 to 16. Other reductions are readily obtained by one sliding adjustment. For enlarging work, the tracing stylus and cutter-spindle assemblies are simply removed and their positions reversed on the "Ratiobar."

Using a 1 to 2 ratio, the cutter point will cover a rectangular area of 4 1/2 by 9 1/2 inches and a circular area 5 inches in diameter. Using a 1 to 16 ratio will restrict the coverage of the cutter point to a rectangular area of 9/16 by 1 3/16 inches and a circular area 5/8 inch in diameter. The cutter-spindle collet size is 5/16 inch, and the cutter-spindle has a feed of 5/16 inch. The vertical movement of the spindle, exclusive of the feed, at a 1 to 2 reduction ratio is 1 inch. The 8- by 12-inch worktable has a vertical feed of 9 3/4 inches; a longitudinal feed of 10 inches; a cross feed of 5 inches on work up to 3/4 inch thick, and of 2 7/8 inches on thicker work.

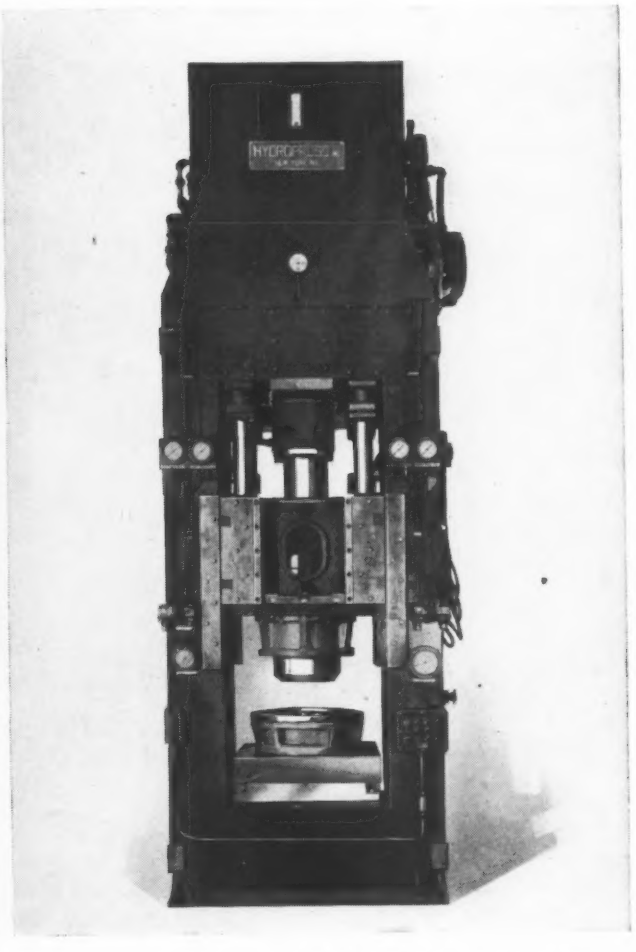
The maximum distance from the spindle nose to the table top is 9 3/4 inches. The six spindle speeds range from approximately 4560 to 18,000 R.P.M. Standard equipment includes a 1 1/4-H.P. 1725-R.P.M. motor and a manual starter. 72

High-Speed Deep-Drawing Press

A hydraulic, double-action, deep-drawing press of the self-contained oil hydraulic type, designed to operate at very high speed, has been built by Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y. As shown in the illustration, the press frame is a box type all-steel one-piece weldment of rigid construction, in which the cast-steel main and blank-holder cylinders are inserted. The complete oil hydraulic drive with pumps and motors is mounted on the press proper. Push-buttons are provided which actuate the valves by means of solenoids. The press is arranged for manual, semi- or fully-automatic control.

The main slide of the press has a capacity of 100 tons, while the capacity of the blank-holder slide is 50 tons. The two slides can be coupled together to obtain a capacity of 150 tons for single-action work. Drawing speeds up to 225 inches per minute can be obtained, depending on the motor size, at pressures up to 100 tons on the main slide. Fast advance and return speeds range up to 1200 inches per minute. Blanks can be drawn to a wide range of depths and shapes. The speed and adaptability of this machine make it useful in manufacturing household utensils from light metals and stainless steel. 73

Gorton Three-dimensional Pantograph Machine



Hydropress Double-action Hydraulic Deep-drawing Press

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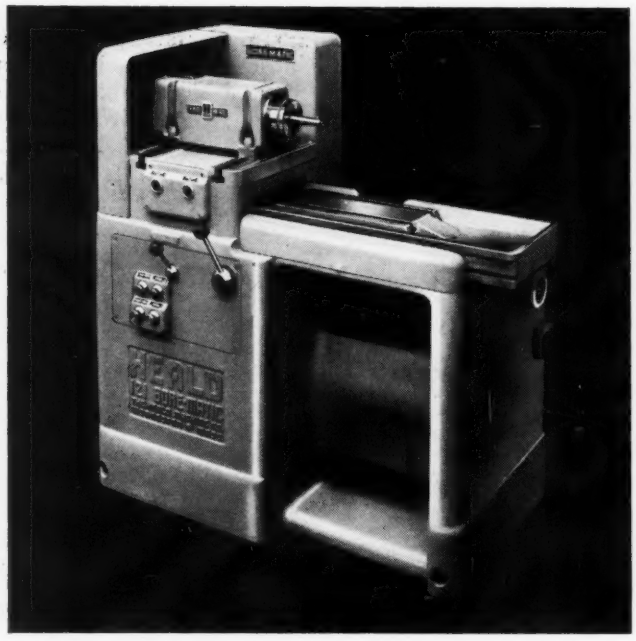


Fig. 1. Heald Single-end Bore-Matic Designed for Handling a Wide Range of Small Work

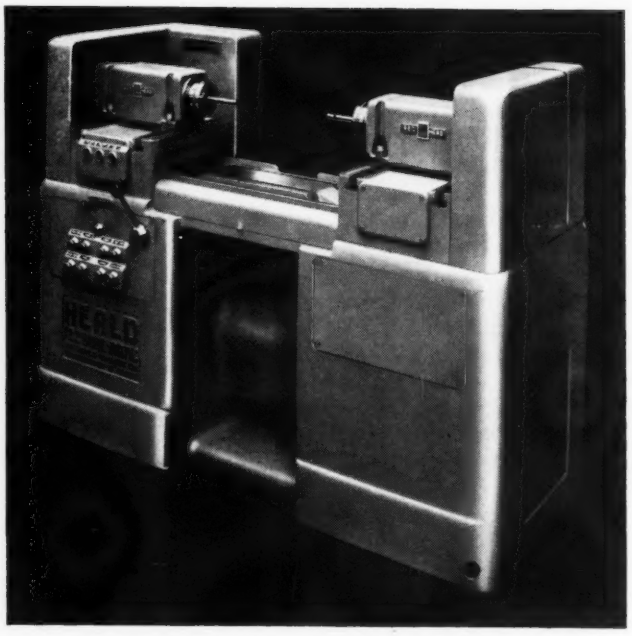


Fig. 2. Heald Double-end Bore-Matic Developed for the Rapid Handling of Small Work

Heald Bore-Matics and Centerless Internal Grinders

The Heald Machine Co., Worcester 6, Mass., has recently added two machines to its line of Bore-Matics and two internal centerless grinding machines to its line of grinding equipment. The new Bore-Matics, shown in Figs. 1 and 2, have been developed to meet the need for smaller machines of this type.

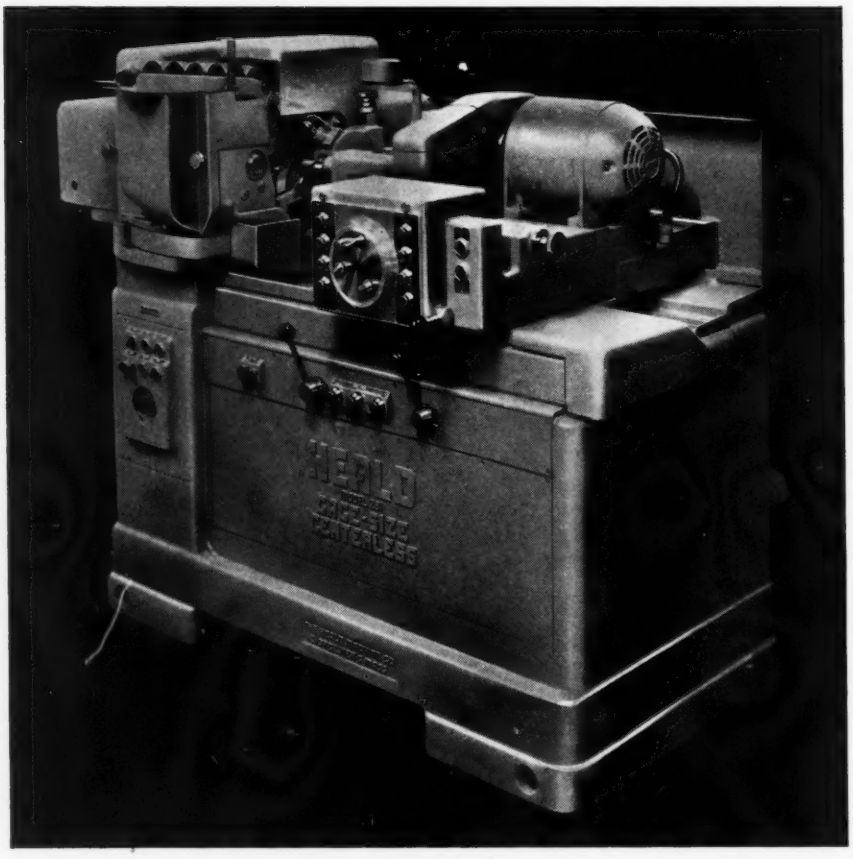


Fig. 3. Heald Centerless Internal Grinding Machine Designed for Fully Automatic Operation

Both the single- and double-end Bore-Matics can be arranged with one or two spindles, and equipped with simple hand-operated fixtures for short-run jobs or with fully automatic fixtures for high-production work. They are designed for rapid, accurate, and economical handling of finish boring, turning, facing, chamfering, grooving, or fly-cutting operations on a wide variety of small work.

Both machines have 16-inch wide bridges; table pads, 7 by 15 inches; table width, 11 3/4 inches; distance from top of table to floor, 33 inches; fast range of table in-feed 1/2 to 100 inches per minute; slow range of in-feed or out-feed, 1/2 to 50 inches per minute; and rapid traverse, 20 feet per minute. The standard head-drive motor is 2 H.P., operating at 1800 R.P.M.

The single-end machine requires a floor space of 53 3/4 by 40 inches, with the cutting fluid tank, and weighs about 2400 pounds. The double-end machine requires a floor space of 64 1/2 by 40 inches, with the tank, and weighs 3300 pounds.

The new Model 281 centerless internal grinding machine, shown in Fig. 3, and the larger Model 381 (not illustrated) are designed for mass production and high-precision work on medium to large size parts which can be rotated on

To obtain additional information on equipment described on this page, see lower part of page 226.

their outside diameters while the bore is being ground.

The smaller machine will handle work having a maximum outside diameter of 4 1/2 inches and will grind holes up to 3 inches in length and as small as 1/4 inch in diameter, or smaller in some cases. The maximum included angle of taper that can be ground on this machine is 60 degrees. Table speeds range from 0 to 30 feet per minute, and the table has a travel of 8 1/2 inches. The motor equipment includes a 2-H.P. 1800-R.P.M. 60-cycle main drive motor; 5-H.P. 3600-R.P.M. wheel-head motor; 1/4-H.P. 1800-R.P.M. regulating wheel motor with speed reduction; and a 1/4-H.P. 1800-R.P.M. coolant pump motor. The floor space required, with coolant tank, is 78 1/4 by 61 inches, and the weight 7095 pounds.

The Model 381 centerless grinder will handle work up to 9 inches outside diameter, and will grind holes up to 6 inches in length and as small as 3 inches in diameter, or smaller in some cases. This machine requires a floor space, with coolant tank, of 102 1/2 by 66 1/4 inches, and weighs about 8900 pounds.

General features common to both sizes of centerless grinding machines include: New feed mechanism, so arranged that the rate and amount of roughing and finishing feeds, as well as the amount of retraction and compensation, are set by turning graduated knobs on the feed-box; indicator showing readings of correct wheel-head belt tension for obtaining longer wheel-head and belt life; and new sealed-in lubrication of work-head and grinding head. 74

Lusol Cutting Coolant

The Anderson Oil Co., Inc., 508 Brownstone Ave., Portland, Conn., has developed a liquid concentrate known as "Lusol," which can be used with ten to seventy-five parts of water to produce a cutting coolant that will meet the requirements of high-speed production on tough alloys. When mixed with ten to seventy-five parts of water, Lusol produces a solution, not an emulsion. It is claimed that this product does not evaporate and will not become rancid. It has low inter-facial tension, which permits it to flow between the tool and the chip rapidly, and thus prevents heating. 75

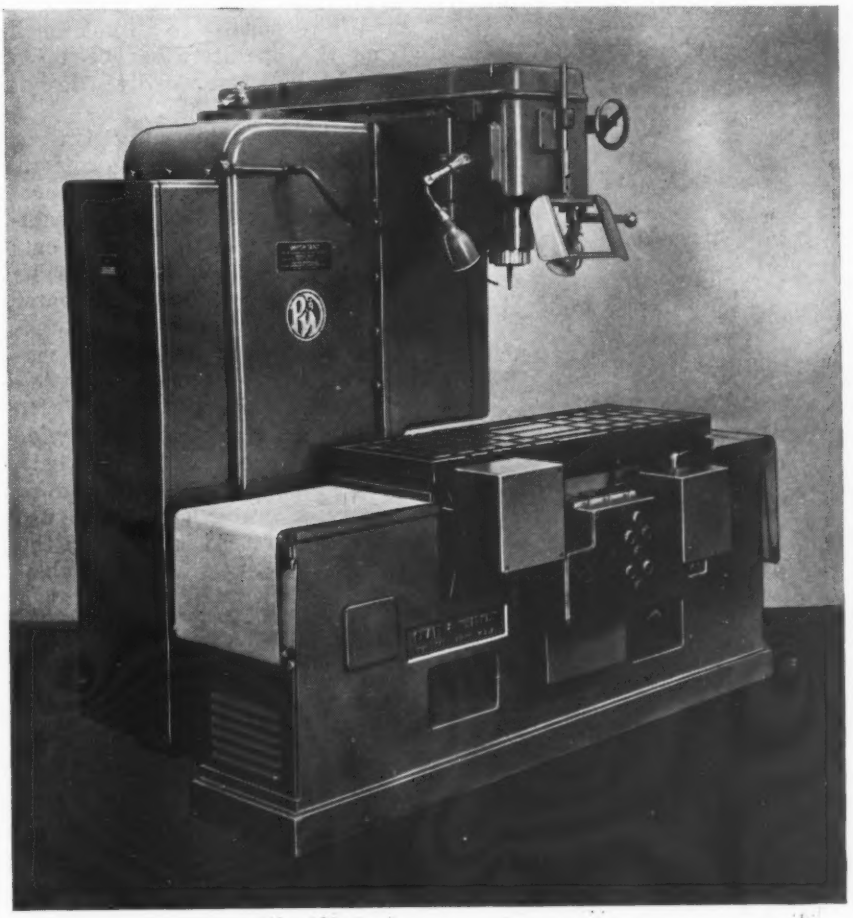
Pratt & Whitney Power-Operated Die-Sinking Machine

Pratt & Whitney, Division Niles - Bement - Pond Co., West Hartford 1, Conn., has brought out a new No. 4D die-sinking machine designed to produce original forging dies, die-casting dies, molds, and similar work with a high degree of accuracy, speed, and economy. All machine motions are power-operated, with speeds and feeds infinitely variable, but with all motions under pilot hand control. With the difficult hand-feeding thus eliminated, the machine fills the gap between the conventional hand-operated die-sinking machine and the fully automatic form or contour reproducing machine. Although radically different in appearance and operation from the hand-operated No. 4 Pratt & Whitney die-sinker brought out several years ago, the new machine has practically the same capacity as the earlier one.

The three fundamental machine motions necessary for die-sinking are provided through a longitudinally moving horizontal work-table of fixed height and a vertical slide carrying a transverse cutter-spindle slide. Movements of these slides, always made under power, are governed by the new Pratt & Whitney "Directron" control, which permits the compounding of two travel movement components.

The "Directron" control consists of a single-lever device, which, by novel electrical means, controls automatic continuous compound movements in any direction and in either a horizontal or a vertical plane. With it, the lay-out lines on the die surface are followed exactly under practically effortless pilot hand control.

For the machining of certain impressions having one or more areas of constant cross-section, templets representing the various longitudinal or transverse cross-sections are mounted on the machine, and these are traced in their respective planes by an electric follower which controls the corresponding machine mo-



Pratt & Whitney "Directron"-controlled Power-operated Die-sinking Machine

To obtain additional information on equipment described on this page, see lower part of page 226.

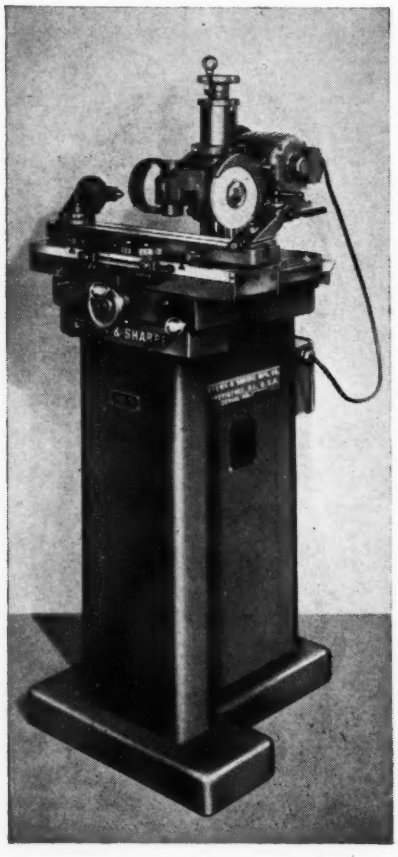
tions automatically and with extreme accuracy. For other cavities which cannot be produced conveniently by either the "Directron" alone or by the use of cross-section templets, a model table is furnished, and such cavities can be machined from models with the aid of the electric follower used in conjunction with the "Directron" control lever.

The longitudinal, transverse, and vertical feed rates are infinitely variable, and rapid traverse movements are provided. Spindle speeds range from 35 to 1750 R.P.M. The spindle has a new design ball-bearing collet closer of the wrenchless type to facilitate quick cutter changes. The machine operates on standard alternating-current voltages with the necessary direct current provided by a rectifier, furnished as regular equipment. A motor of about 4 1/2 H.P. is required.

The machine weighs about 10,000 pounds, and is approximately 80 inches wide, 72 inches deep, and 83 inches high. The distance from floor to top of table is 34 inches, and the distance from table surface to end of collet ranges from 12 to 28 inches. While the machine illustrated has a working surface 16 inches wide by 43 inches long, a longer bed and table can be furnished for die-sinking operations on longer dies. 76

Brown & Sharpe Cutter and Tool Grinding Machine

A new No. 5 cutter and tool grinding machine designed for faster, easier handling of toolroom sharpening jobs on the smaller class of cutters has been added to the line of machine tools built by the Brown & Sharpe Mfg. Co., Providence 1, R. I. This machine will sharpen cutters up to 6 inches in diameter by 4 inches long, and is similar in design to the larger No. 10 tool and cutter grinder. Rigidly constructed parts of lighter weight used in the smaller machine have been especially designed to combine speed with accuracy. Super-sensitive operation of the machine, which is readily responsive to a light touch from the operator, has been obtained by noteworthy design features.



Brown & Sharpe Cutter and Tool Grinder Designed for the Rapid Sharpening of Small Milling Cutters and End-mills

Set-ups for sharpening straight and helical tooth milling cutters, face mills, end-mills, angular cutters, straight and tapered reamers, and many other types of cutters within its capacity can be made quicker and with greater accuracy as a result of new features incorporated in this machine.

Provisions have been made to facilitate the grinding of a wide range of cutters with both cup and straight wheels, and to enable the cutter grinder to use his own preferred methods in the simplest manner. The double-ended wheel-spindle, driven at a constant speed of 3800 R.P.M. by V-belt from a 1/4-H.P. motor, is mounted in permanently sealed, grease-lubricated type super-precision ball bearings. The spindle can be equipped with a flaring cup-wheel at one end and a straight wheel at the other.

The wheel-spindle slide has the top and bottom surfaces finished for use with a height gage that facilitates setting up for grinding cutters with any desired clearance. The wheel-slide has a vertical adjustment of 5 1/2 inches, and is operated by a handwheel with 0.001-inch graduations. The spindle-slide upright has a transverse movement of 4 1/2 inches, also operated by a handwheel with 0.001-inch graduations. It has a longitudinal adjustment of 3 inches, and can be swiveled to position the spindle either at right angles or parallel to the table.

The swivel table has a working surface of 24 3/4 by 3 1/2 inches, and can be swiveled through an angle of 360 degrees, provision being made for fine adjustment to the desired angle. The sliding table on which the swivel table is mounted has a longitudinal movement of 6 inches. This table is supported by precision-ground rolls, which permits it to be easily moved longitudinally in either direction.

A rack and pinion arrangement provided at each end of the table enables the operator to move the table back and forth by means of a knob or crank. The knob is easily interchanged with the crank shown to the right of the centrally located handwheel. Either the knob or crank can be placed on the pinion-shaft at the left end of the table or on either of the pinion-shafts at the rear of the table, making it possible for the operator to control the longitudinal table movement from the most convenient of four positions.

The length of the table movement is controlled by positive stops and adjustable table dogs with spring plungers for reducing shock and minimizing the operating effort at each table reversal. The center head, mounted on the left-hand end of the swivel table as shown, carries the work-center or work-head and can be swiveled in both horizontal and vertical planes. The footstock, shown at the right-hand end of the swivel table, can also be adjusted along the table. The footstock spindle can be withdrawn by either a spring lever or a screw and knurled nut. A graduated scale on the footstock simplifies accurate setting of a cutter for grinding any desired clearance angle up to 20 degrees.

A variety of special or additional equipment is also available, including raising blocks for the center head and a footstock for grinding steep angles with a flaring cup-wheel. The machine re-

To obtain additional information on equipment described on this page, see lower part of page 226.

quires a floor space of 30 5/8 inches by 36 1/2 inches. The weight is approximately 585 pounds. 77

Resistance Welder Power Supply Unit for Direct-current Spot, Projection, and Flash Welding

Kinetic Stored-Energy Power Unit for Resistance Welding

The Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich., has brought out a kinetic stored-energy power supply unit employing an ingenious flywheel and rotor assembly for resistance welding. With this Caputo-Crawford kinetic stored-energy system, the source of power for operating a resistance welder is an ordinary three-phase alternating-current motor of 15 to 40 H.P. Thus, direct-current spot, projection, and flash welding can be performed where power facilities are limited to a three-phase supply line.

Advantages claimed for this new equipment include low power demand from lines; no transient surges; high power factor; a truly balanced load; no special transformers or distribution system; no electrical interference with other equipment; simple timers and controls; and easier and simpler maintenance. 77-A

Acme Hydraulic Horizontal Broaching Machine

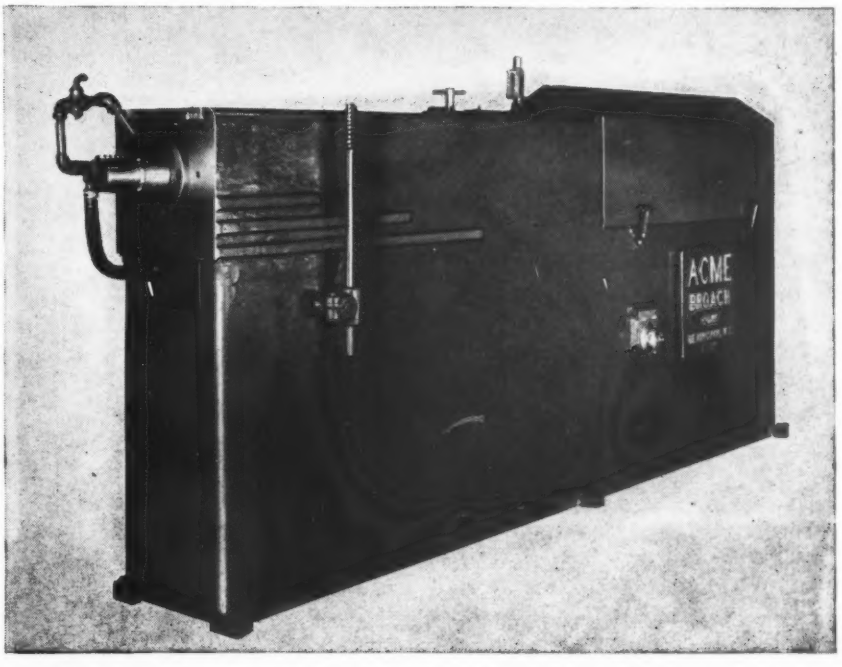
The Acme Broach Corporation, E. Third St. at Delaware, Lexington 21, Ky., has added to its line of broaching machines a new horizontal hydraulically operated model which is being manufactured in 4-ton, 36-inch stroke, and in 2-ton, 36-inch stroke capacities. This machine is totally enclosed, and the hydraulic oil filler spout is placed under the hood, where it is readily accessible to the operator, but so located that it is not likely to be tampered with. Inspection of the motor, hydraulic pump, and control valve, as well as the complete hydraulic unit, can be made by opening the hood at the back of the machine.

The machine is equipped with dual cylinders—the main pulling cylinder, operating a pull-slide having a cutting speed of 15 to 30 feet per minute, which is directly in line with the faceplate bore of the machine; and a high-speed return cylinder, mounted just above the main cylinder, which returns the pull-slide to the starting position at a speed of 48 feet per minute. The pull-slide is fitted with adjustable take-up liners which slide on hardened and ground ways. The pull-bolt, which receives the broach-puller, is provided with a tightening nut which eliminates all lost motion and provides a positive and rigid position for the broach-puller. This feature is said to eliminate broach breakage formerly caused by head backlash.

The bore in the faceplate of the machine is 5 inches in diameter, and the distance from the faceplate to the front of the pull-bolt is 3 1/2 inches. A 3-H.P., 1200-R.P.M. motor is required for driving the machine under normal loads. The normal working pressure per square inch for the smaller size machine is 430 pounds, and for the larger machine 400 pounds. The coolant reservoir has a capacity of 15 gallons. The distance from the floor to the center of the faceplate bore is 37 inches. The machine requires a floor space of 2 feet by 8 feet 4 inches. The smaller machine weighs 2820 pounds, and the larger machine 3010 pounds.....78

Airco Flux for Gas Welding of Stainless Steel

The Air Reduction Sales Co., Department 1630, 60 E. 42nd St., New York 17, N. Y., has recently announced a new flux for oxy-acetylene welding of stainless steels and high-chromium bearing alloys. This flux, designated Airco Formula No. 34, is specifically compounded to dissolve the chromium oxides encountered in welding these materials. Painting the flux on the immediate and surrounding surfaces to be welded



Acme Hydraulically Operated Broaching Machine

To obtain additional information on equipment described on this page, see lower part of page 226.

serves to protect the molten metal from the air and thus prevents oxidation. Extensive field trials are said to have shown that this flux is far superior to those previously brought out by the company for stainless-steel welding, including the flux known as Kromeweld, which it replaces. 79

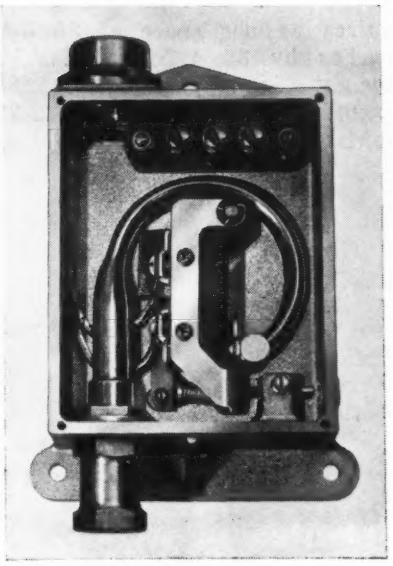
Knight Milling and Precision Boring Machine

The W. B. Knight Machinery Co., 3920 W. Pine Blvd., St. Louis 8, Mo., has introduced on the market a combination vertical milling and precision boring machine incorporating several new features. Although adapted to an extremely wide range of work, this No. 50 machine is exceptionally easy to operate. The speeds and power available make possible very rapid metal removal.

The base of the machine is a one-piece semi-steel casting designed to provide the rigidity required for precision work. For shops doing a variety of work, this machine offers all the advantages of an accurate solid-base boring machine and a rigid vertical milling machine. 80

Pressure-Operated Switch for Controlling Machine Tool Mechanisms

A new pressure-operated switch designed for use as a control mechanism for machine tools, pneumatic and hydraulic systems, heating and air-conditioning equipment, and a variety of other industrial applications has been added to the line of switches actuated by liquid, air, or gas pressure manufactured by the Meletron Corporation, 950 N. Highland Ave., Los Angeles 38, Calif. Convenient adjustment, explosive-proof design for hazardous installations, and construction that prevents tampering with the preset controls for the operating characteristics are features embodied in the new switch. 81

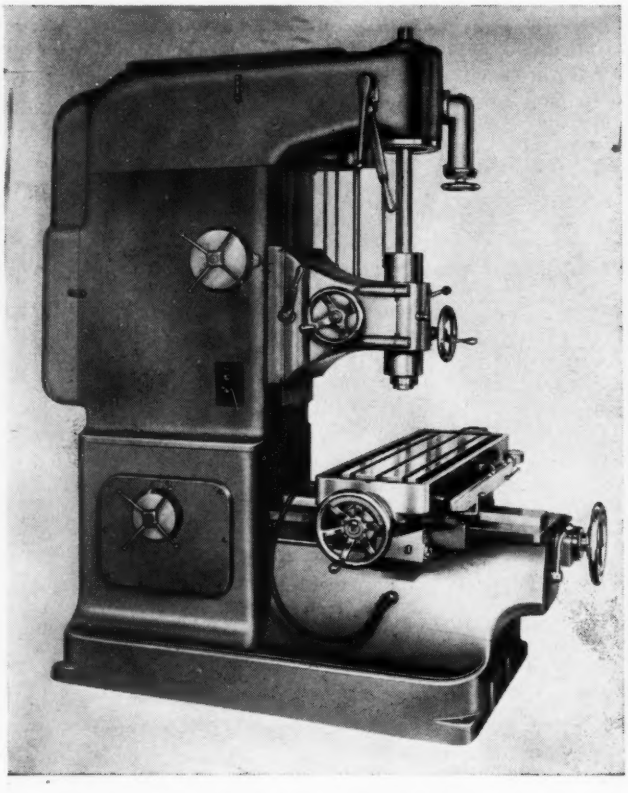


Meletron Pressure-operated Switch

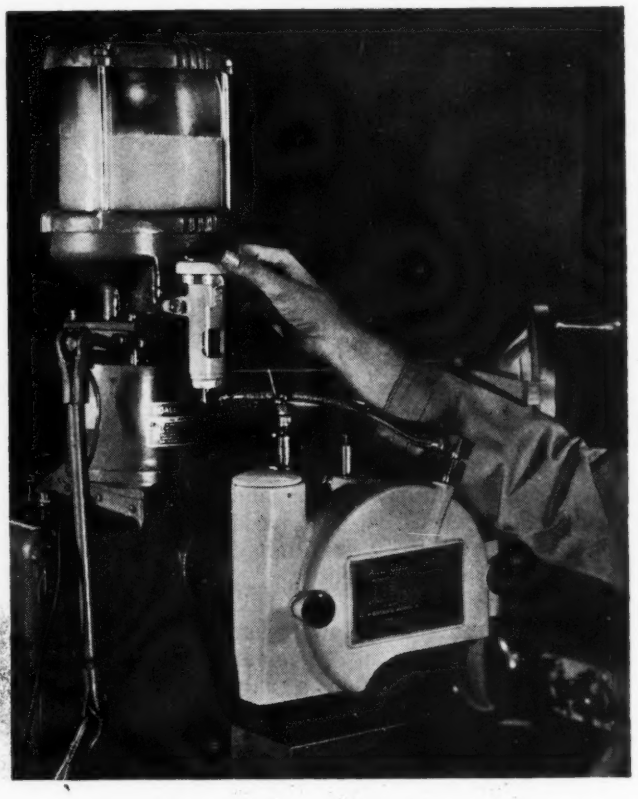
DoAll Coolant Injection Unit for Grinding Wheels

The DoAll Company, Des Plaines, Ill., has introduced a revolutionary method, known as "Cool Grinding," for cooling work being ground by any type machine. With this method, operators of grinding machines have the twofold benefits of being able to observe the work as clearly as when dry grinding, and at the same time, have fingertip control over an adequate cooling system.

The introduction of coolant directly at the point of contact between the wheel and work is the basic principle of the new method. It eliminates the need for splash guards, settling tanks, pump mo-



Knight Combination Vertical Milling and Boring Machine



"Cool Grinding" Coolant Unit Applied to Surface Grinder

To obtain additional information on equipment described on this page, see lower part of page 226.

tors, hose, and floor space formerly occupied by cooling units. This represents a considerable saving in equipment costs plus additional savings in coolant oils, since only a small amount of coolant is used.

The "Cool Grinding" unit consists of a coolant reservoir mounted on the spindle column, a sight drip valve, and a special wheel adapter. The coolant is fed from the reservoir at the rate of one to four drops a second, depending upon the material being ground. It is directed into the front of the wheel adapter, where it enters the arbor hole of the grinding wheel. Since the grinding wheels used with this method have no lead or ceramic sections, the coolant enters the wheel at its inner surface, and is thrown by centrifugal force to the outside grinding face, where it is applied at the "Cool Grinding" point. Tests have been made in which it is claimed that temperatures are held several hundred degrees lower by this method of applying coolant, and that it virtually eliminates surface cracks.

Since the new system causes the coolant to flow through the wheel, it has the advantage of cleaning or flushing the grinding surface. This results in longer wheel life and better finishes, especially when grinding soft materials, such as copper and aluminum.

The new unit is made at present as an attachment for DoAll 6- by 18-inch surface grinders. However, it will soon be available for other makes of surface grinders, as well as for bench, cylindrical, centerless, and internal grinding machines. 82

Fig. 1. Steel Car Wheels before and after Tread is Profile-turned

Niles Car-Wheel Lathe with Hydraulic Feed

The time required for machining the treads of mounted steel car wheels such as shown in Fig. 1 has been reduced to fourteen minutes per wheel by the new line of wheel lathes brought out for railroad shop use by the Niles Tool Works Co., Division of Lima-Hamilton Corporation, Hamilton, Ohio. The hydraulic tread contouring equipment of these machines, shown in Fig. 2, which is largely credited with this reduction in machining time, has also made it possible to hold the work to much closer limits with respect to concentricity. The mirror-like surfaces of the treads machined by this equipment are readily held within concentricity limits of 0.0015 and 0.005 inch, and require no grinding, even when the wheels are used for trains operated at 100 miles per hour.

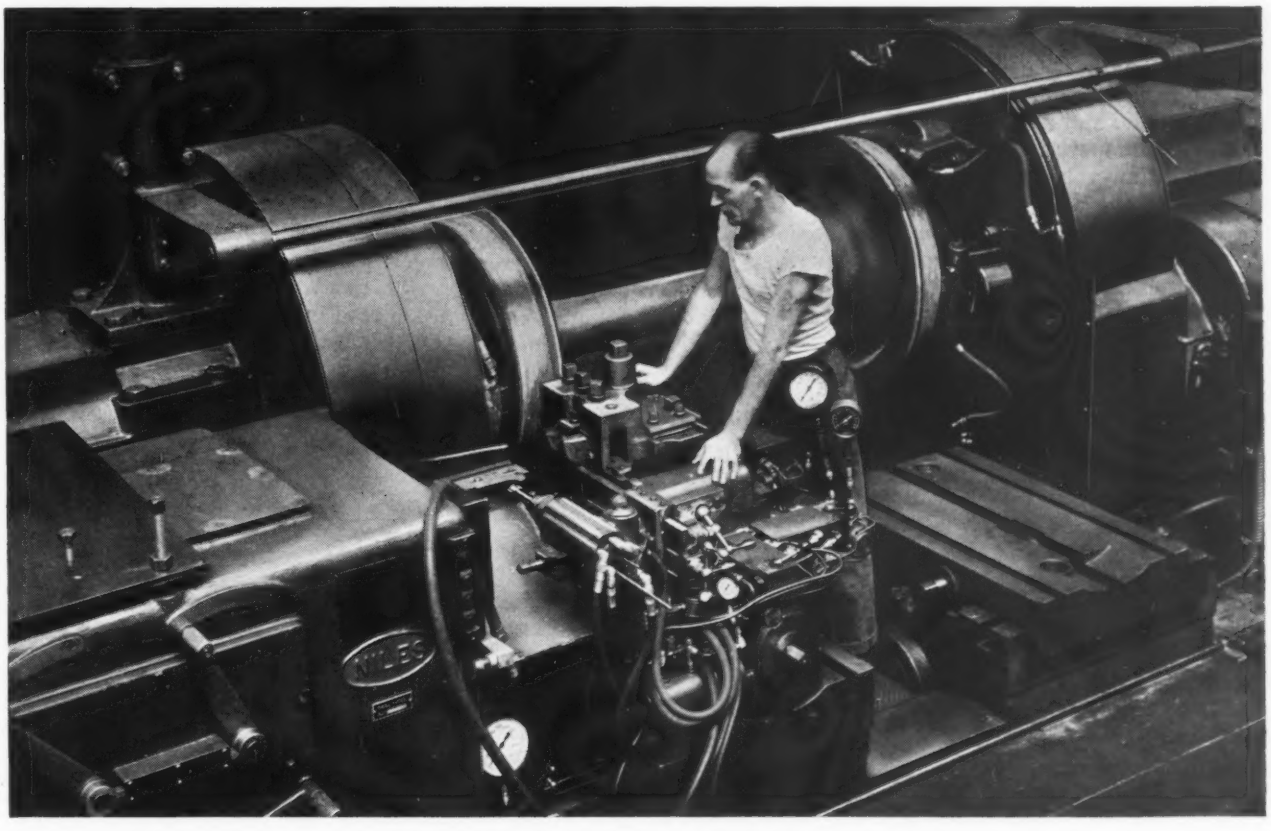


Fig. 2. Car-wheel Lathe Equipped with Hydraulic Profiling Attachment for Machining Treads, Built by the Niles Tool Works Co.

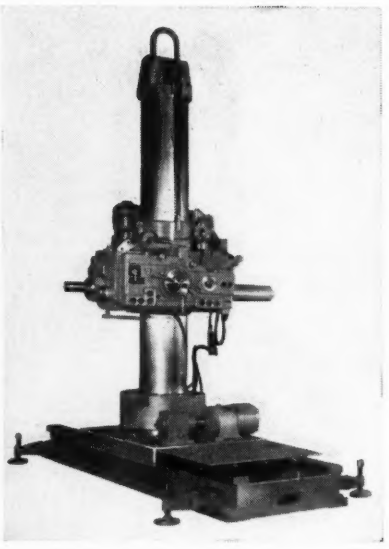
To obtain additional information on equipment described on this page, see lower part of page 226.

The hydraulic feeds, greatly improved pneumatic driver dogs, anti-friction faceplate spindle bearings, and increased rigidity which insures maximum life for the tungsten-carbide tools are outstanding features of these lathes. The tungsten-carbide tipped tool used with the profiling attachment makes one contour-forming pass over the entire tread of a steel wheel at cutting depths up to 3/4 inch and feeds up to 1 inch per minute. Two of the new hydraulic profiling attachments are used to replace the conventional four-turret type forming tool equipment. 83

Westinghouse Low-Voltage Industrial Welder

A new line of Flexarc alternating-current industrial welders of smaller design than preceding models has been announced by the Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. A sturdy, compact, streamline case and an interior with reactor and transformer built around high-permeability Hipersil steel cores are features of this new "65 Line." These welders are especially designed to assure high arc stability in the lowest as well as the highest current ranges of the five output ratings—200, 300, 400, 500, and a duplex rating of 300-600 amperes.

Built-in low-voltage control provides high operating efficiency in the low current range, and built-in capacitors assure a high power factor and economical full rated operation. Fan cooling is used on the 500-ampere welder. 84



Kaukauna Tilting Head Drilling and Tapping Machine

Kaukauna Portable Horizontal Drilling and Tapping Machine

The Kaukauna Machine Corporation, Kaukauna, Wis., has brought out a new portable horizontal drilling and tapping machine with a tilting horizontal head adapted for all kinds of drilling and tapping operations. The compactness and portability of this machine enable it to be used in restricted areas, thus simplifying many difficult machining problems. Full three-dimensional power traverse and swiveling of the headstock make it possible to perform operations through an angular range of 45 degrees above or below the horizontal.

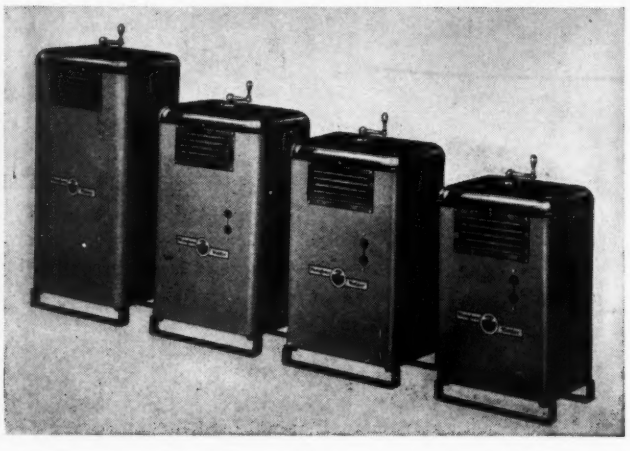
The machine spindle can be placed in virtually any position through the power elevation of the headstock on the column; the column and sub-base power traverse on the runway; the tilting of the headstock; and the rotation of the column through an angle of 360 degrees on the sub-base.

The machine has nine spindle speeds, three spindle feeds, a 24-inch longitudinal continuous travel of the spindle, and a 48-inch horizontal travel of the column on the runway. It will drill holes up to 3 inches in diameter in cast iron. 85

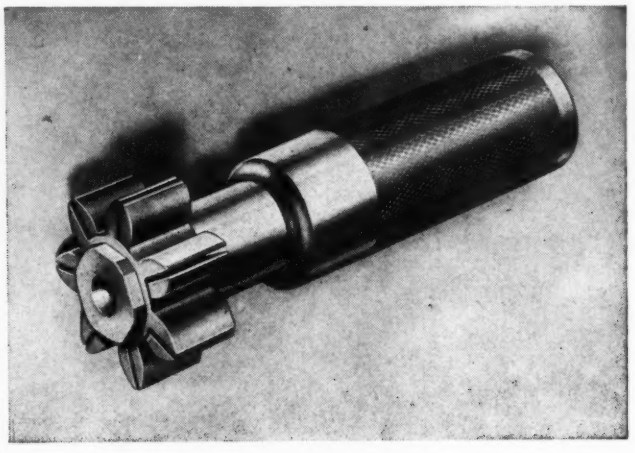
Gear Tooth Form of Variable Thickness for Gaging and Chucking

A mechanical device or mechanism that provides a gear or spline tooth form, the width of which can be adjusted for gaging, workholding, or locating purposes, has been developed by the MP Tool & Engineering Co., Detroit, Mich. The device, as incorporated in the gage shown in the illustration, has individual left- and right-hand tooth profile members extending the full width of the gear tooth to be gaged. These profile members are rolled toward or away from each other in such a manner as to vary the tooth thickness or tooth space while retaining the full profile bearing surfaces.

When used for checking internal gears, the gage will check the teeth only, regardless of the actual width of the broached tooth spaces or the wear which may have occurred in the locator. This is made possible by the use of a torsion



Four Sizes of Flexarc Welders Brought out by the Westinghouse Electric Corporation



Gear-tooth Gage with Mechanism Designed for Varying the Thickness of the Gaging Tooth

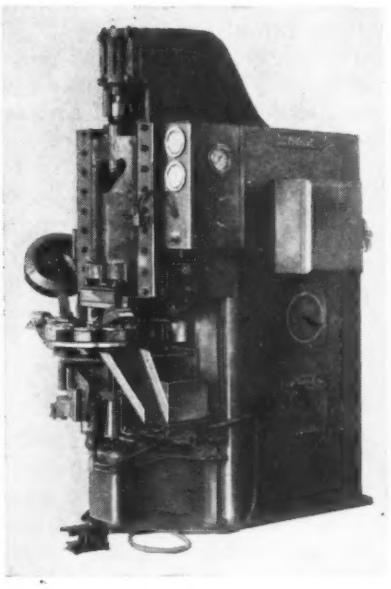
To obtain additional information on equipment described on this page, see lower part of page 226.

spring which holds the tooth profiles outward to give a gaging tooth thickness somewhat larger than any broached tooth space.

With suitable modification, this tooth-width adjustment development can be applied to gaging devices for checking internal and external splines and gears, as well as to a wide range of work locating and holding devices, including self-centering adjustable gear chucks for diamond boring operations. A locking rotary motion can be imparted to the adjustable teeth through a draw-bar, helical slot, and cam follower arrangement, which can be operated mechanically, hydraulically, or pneumatically. 86

Murco Variable-Speed Tumbling Barrel

A new Murco tumbling barrel is being manufactured by the D. J. Murray Mfg. Co., Wausau, Wis., for deburring, burnishing, cleaning, and polishing metal and plastic parts on a mass production basis. Speed changes can be made while the barrel is in motion to suit a wide range of operating requirements. Specially designed dump pans are mounted on casters and are provided with a bail handle that is notched to accommodate the crane hook. All moving parts, such as the barrel, gears, pulley, and motor, are designed with a view to safety of operation. 87



Federal Hydraulic Projection Welding Machine for Push-rod Assemblies

Federal Hydraulic Projection Welder

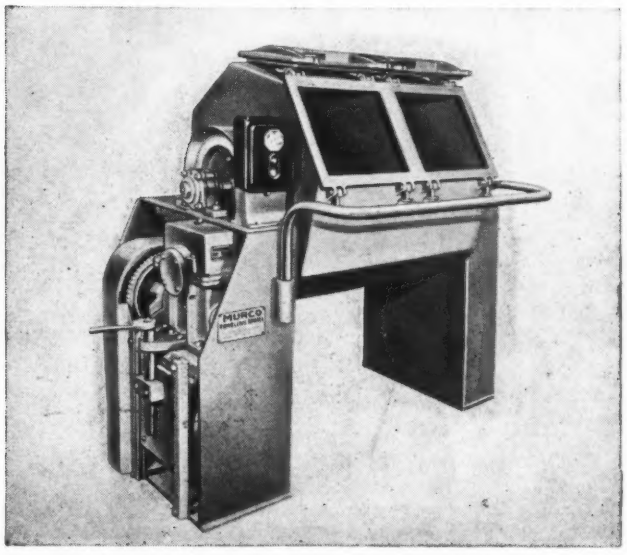
A high-production hydraulic projection welder designed for welding gasoline-engine push-rod assemblies at the rate of 1200 per hour is announced by the Federal Machine & Welder Co., Department 18, Plant 2, Warren, Ohio. The welded push-rod assemblies consist of two parts, a round alloy-steel disk which forms the head, and a forged-steel cylindrical stem containing a blind hole, the open end of which is projection welded to the disk.

The hydraulically operated, eight-station, automatic dial-feed table is equipped with positive indexing and locking devices. The unit is furnished with eight welding fixtures consisting of solid type copper-alloy dies. These dies have insulated locators for positioning the disks for any one of the various size tappet assemblies which can be welded on the machine. The dies are designed for quick change-over from one size to another. The machine is also equipped with an automatic hopper feed for continuous feeding of the disks, consisting of a hopper, motor-driven agitator, and hydraulic selector mechanism synchronized with the indexing movement of the table.

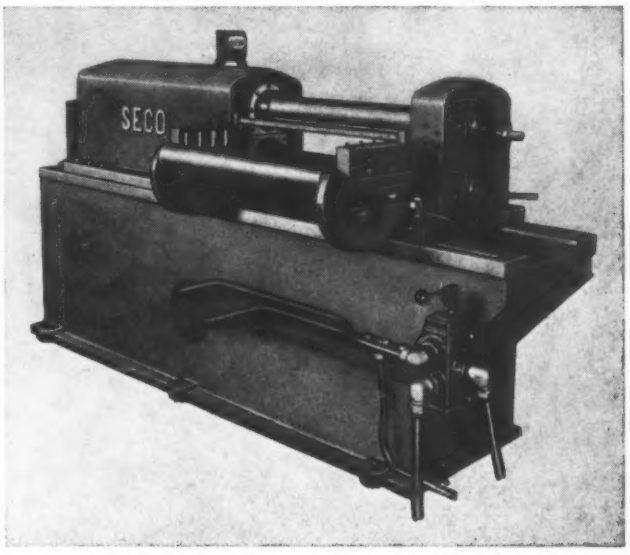
The welder is equipped with a 400-KVA transformer having water-cooled, cast copper secondaries wound for 380-volt, 60-cycle alternating current, and is provided with 16-point series parallel heat regulation. 88

Cleveland Hydraulic Metal-Slitting Machine Line

A metal-slitting machine line made up of slitting units driven by fluid motors, which is believed to be the first line of this kind to be operated entirely by hydraulic power, has been designed by the Steel Equipment Co., 2890 E. 83rd St., Cleveland 4, Ohio. This line is intended to provide complete control over a speed range from zero to the maximum slitting



Variable-speed Tumbling Barrel Made by the D. J. Murray Mfg. Co.



One Unit of a Hydraulic Slitting Line Brought out by the Steel Equipment Co.

To obtain additional information on equipment described on this page, see lower part of page 226.

speed, and to meet unusual tension regulation requirements. Hydraulic power is supplied by one hydraulic pumping unit, using a variable-delivery pump driven by a constant-speed alternating-current motor. Volume control permits the operator to reduce the speed for the threading-in operation to about 35 feet per minute. The line can easily be accelerated to top speed or slowed down without the use of brakes.

Tension regulation of the recoil reel is easily accomplished through pressure control. Pay-off and rewind reel blocks are expanded and collapsed by means of hydraulic cylinders which act upon a push-pull rod. All coil handling equipment is operated by hydraulic cylinders. 89

Optical Projection Comparator Brought out by Engineers Specialties Division

The Engineers Specialties Division, Universal Engraving & Colorplate Co., Inc., 980 Ellicott St., Buffalo 8, N. Y., is placing on the market a new optical projection comparator designed and built by the American Optical Co. The universal basic unit of this projector can be used either on a bench or on its own pedestal. It is adaptable either for inspection of production pieces or as a microscopically precise measuring device.

A micrometer stage and protractor are available for converting the comparator to a measuring instrument which is especially adapted for use in tool and gage laboratories. Special staging fixtures and coordinated chart gages can be made for solving all kinds of complex inspection problems encountered in manufacturing products.

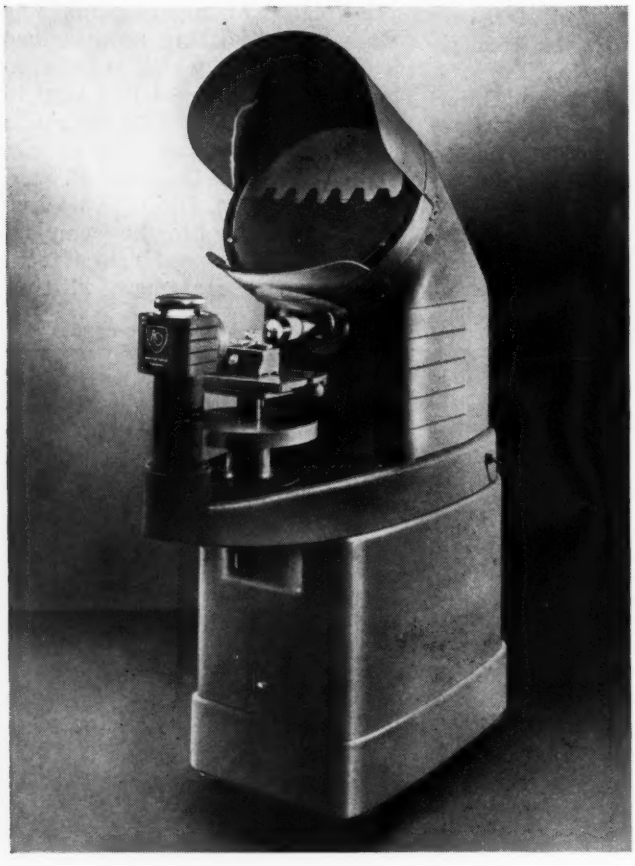
The comparator has interchangeable lenses for magnifications of 10X, 20X, 31.25X and 62.5X in quick-change bayonet type mounts. Distortion-free images are projected on a large screen, 16 inches in diameter.....90

Diamond Punch Presses

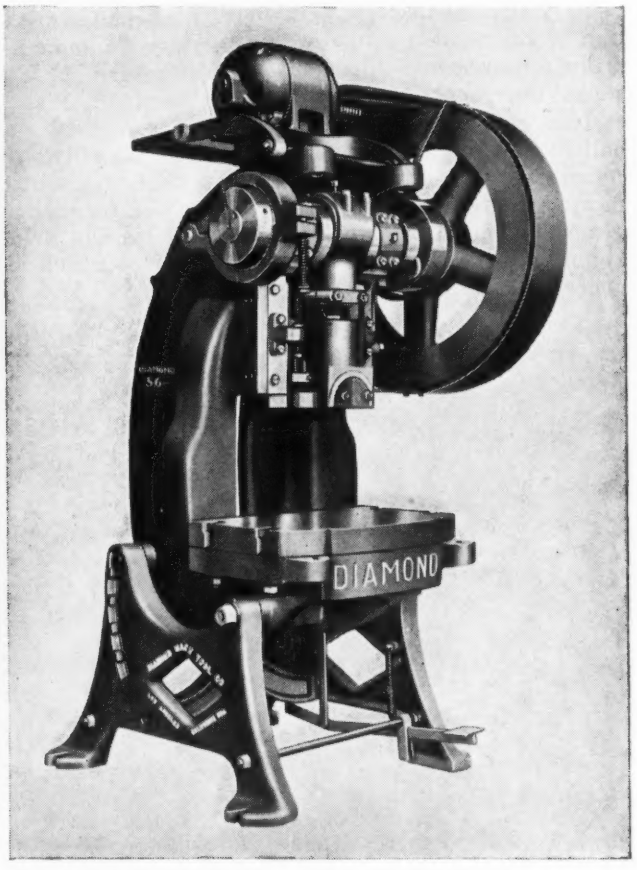
The Diamond Machine Tool Co., Los Angeles, Calif., has added a plain type press, of 55- and 56-ton capacities, to its line of 9-, 14-, 30-, and 31-ton models. These new punch presses are of open-back inclinable construction, the frame sections being designed to provide increased strength at the points of maximum stress, as shown by a strain-gage analyzer.

All bearing and sliding surfaces are micro-finished to obtain longer life and smooth, accurate operation. The clutch employs three sets of driving dogs which engage the flywheel at any 120-degree angle of rotation.

The 56-ton machine has a maximum operating speed of 100 strokes per minute. The standard stroke is 3 inches, and the maximum stroke obtainable on special order is 8 inches. The shut die height is 16 inches; the bed area, 20 by 30 inches; the bed opening, 12 5/8 by 16 1/2 inches; the crankshaft bearing diameter, 4 inches; and the crankshaft diameter, 5 inches. 91



Optical Projection Comparator Made by American Optical Co. and Placed on the Market by Engineers Specialties Division



Plain Type Punch Press, Made in 55- and 56-ton Capacities Recently Added to the Line of the Diamond Machine Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 226.

Sommer-Adams Automobile-Engine Connecting-Rod and Cap Drilling, Reaming, and Counterboring Machine

The Sommer & Adams Co., subsidiary of the Federal Machine & Welder Co., Warren, Ohio, has developed a new high-production special processing machine for drilling, reaming, and counterboring automobile-engine connecting-rods and caps. The machine is over 11 feet high and weighs 36,000 pounds. By the use of this machine, one operator can drill, ream, and counterbore connecting-rods and caps at a production rate of 240 assemblies per hour.

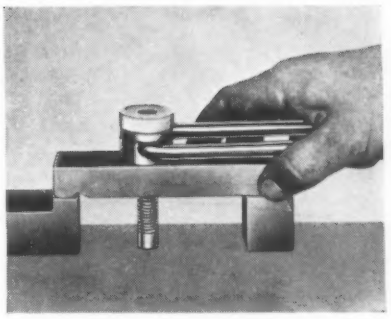
The five stations of the machine are push-button controlled, and the spindles are adjusted for tool set-up purposes through manual controls at each individual station. The machine also has an automatic cycle for continuous operation, and is equipped with a motor-driven hydraulic unit designed specifically for indexing and locking the table.

The hydraulic system employs a 5 P.W.X. variable-displacement pump, which automatically adjusts itself for the correct operating pressure. Each of the five stations has a self-controlled hydraulic system. One motor on each unit operates the multiple-spindle drill head through a train of gears, and each head can be used for drills, reamers, or counterbores. The equipment is supplied with a motor-driven pump which delivers 75 gallons of coolant per minute. An automatic lubrication system is also provided. 92

"Thunder Bay" Presses

The Die Tool Engineering Co., 18800 Hawthorne Ave., Detroit 3, Mich., has increased its line of "Thunder Bay" presses so that it now has models of 100, 150, 200, 250, and 300 tons capacity in a variety of bed sizes. The 150-ton model, shown in the illustration, has a bed size of 41 by 84 inches, and weighs approximately 37,000 pounds.

Features of these presses include double back-gearing, Rockford (Borg - Warner) friction clutch, ball-bearing release, "Tru-Stop" brake, and Alemite one-shot lubrication. Ampco bronze liners are used in the crank bearings to insure long life. All presses have tonnage capacities which are well in excess of their regular specified ratings. 93

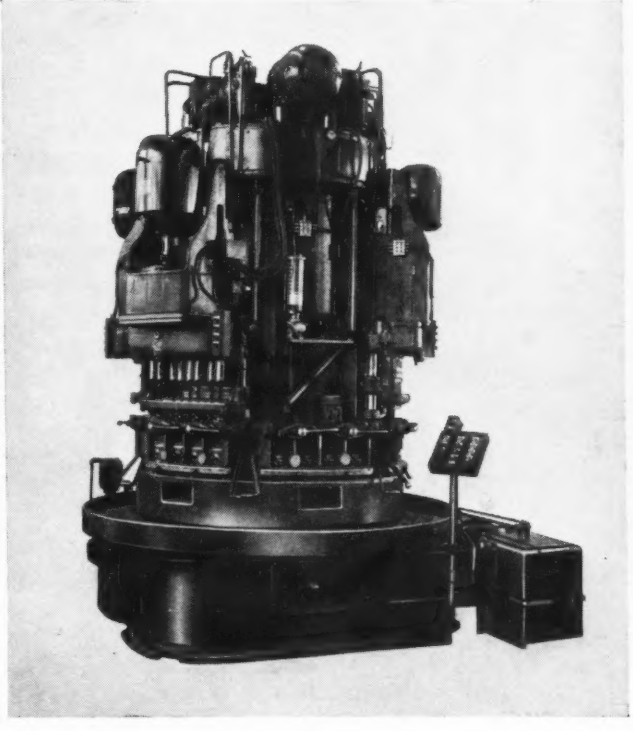


Quick-acting "Jig-Nut"

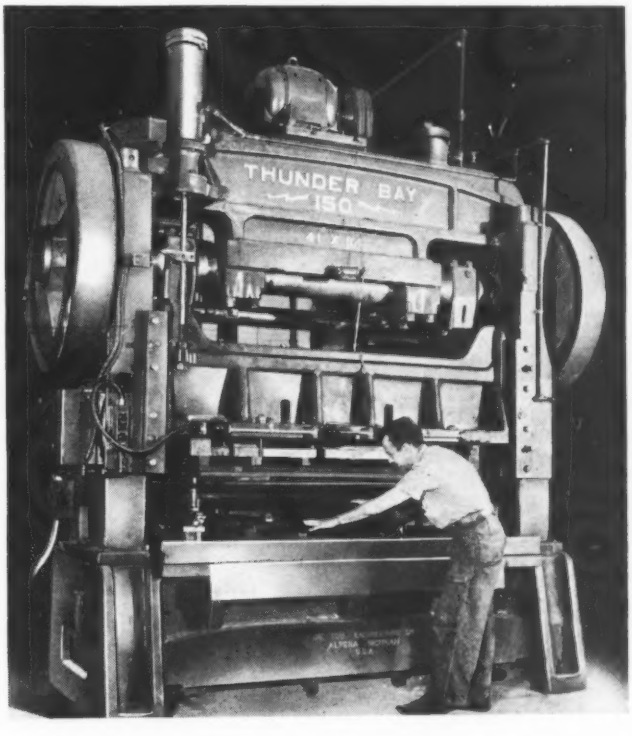
"Jig-Nut" for Work-Holding Fixtures

The "Jig-Nut" here illustrated was developed by the Jig-Nut Corporation, 744 Broad St., Newark 2, N. J., for use with work-holding fixtures or as part of conventional machine set-ups. It eliminates the need for wrenches, and is made to fit standard stud threads.

This quick-acting nut is simply screwed down with the fingers, after which ample clamping pressure is exerted by the cam action obtained by depressing the handle from the vertical to the horizontal position. The handle can be turned to any position radially before it is depressed. The self-locking feature of the device makes the clamping action shakeproof. 94



Automobile-engine Connecting-rod and Cap Processing Machine Developed by Sommer & Adams Co.



"Thunder Bay" 150-ton Model Press Built by the Die Tool Engineering Co.

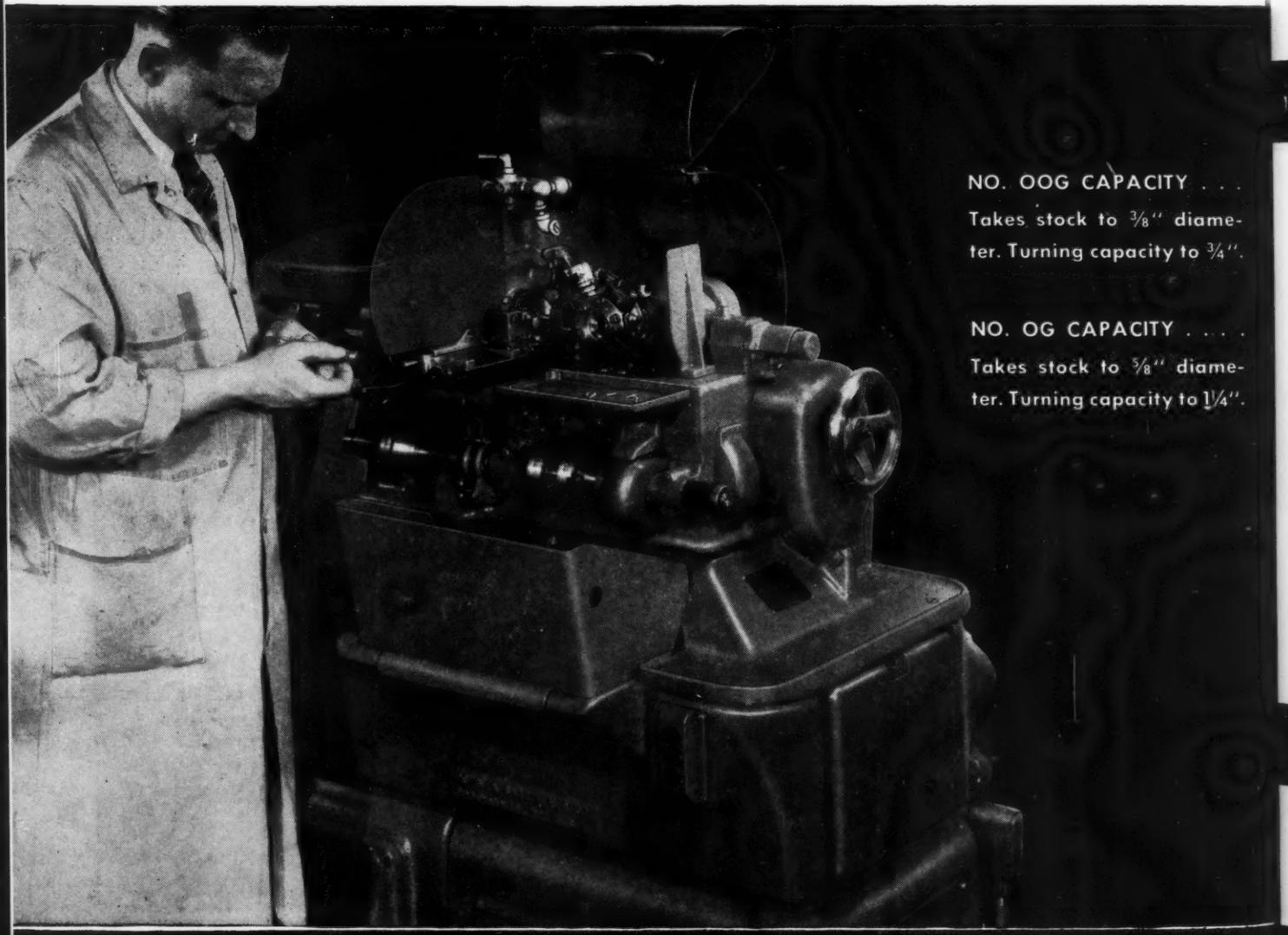
To obtain additional information on equipment described on this page, see lower part of page 226.

Presenting THE NEW DESIGN "OOG" AND "OG" AUTOMATIC SCREW MACHINES

IMPROVEMENTS AND REFINEMENTS have been made in these Automatic Screw and Automatic Cutting-Off Machines to increase their efficiency and to permit the maintenance of closer limits, finer finish and more uniform production.

Spindle is positively driven at all speeds and is provided with 196 two-speed combinations including a wide range of high to low speed ratios. This wide selection of ratios makes possible the use of correct speeds for threading without limiting the selection of efficient high speeds for forming, drilling and similar operations. Equal cutting efficiency is obtained on all materials ranging from tough alloy steels to free-cutting plastics and on the widest range of work diameters.

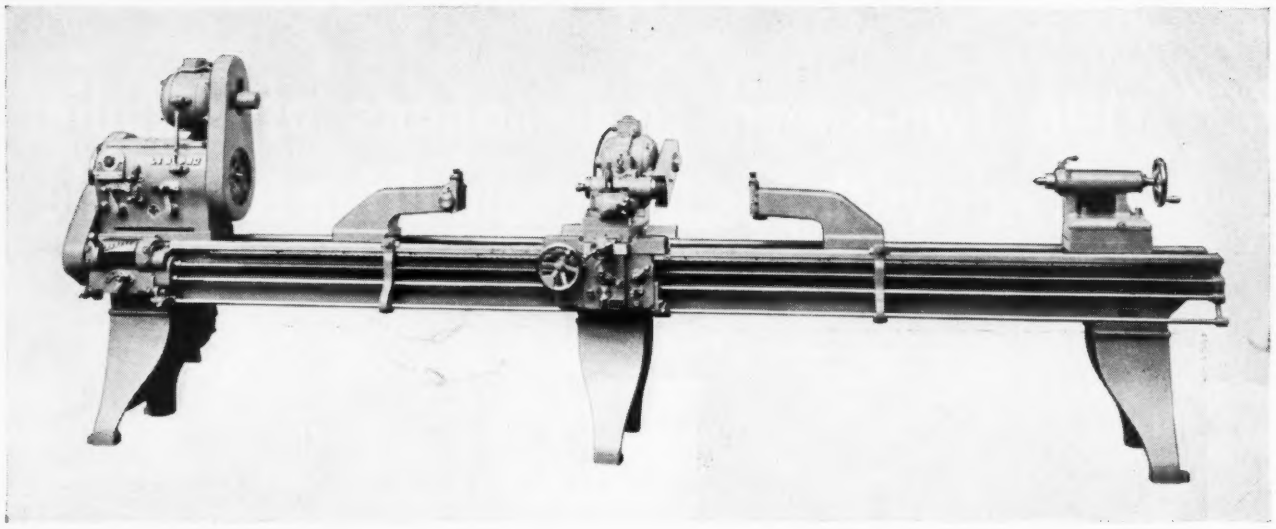
Numerous design and construction details combine to shorten set-up time and a wide assortment of available attachments further increases overall value in terms of investment. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.



NO. OOG CAPACITY . . .
Takes stock to 3/8" diameter. Turning capacity to 3/4".

NO. OG CAPACITY . . . .
Takes stock to 5/8" diameter. Turning capacity to 1 1/4".

BROWN &



Regal Dual-purpose Rubber-roll Polishing and Metal-turning Lathe Built by R. K. LeBlond Machine Tool Co.

Regal Dual-Purpose Polishing Lathe

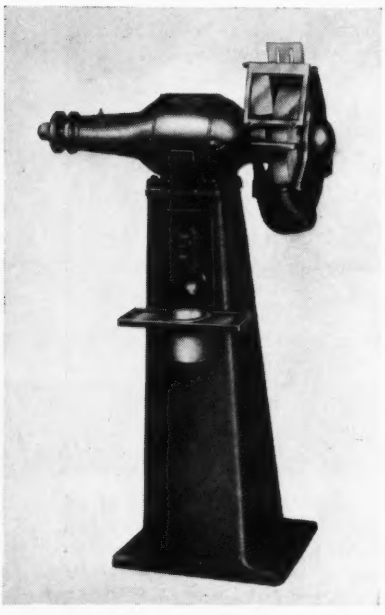
A two-purpose lathe developed for polishing rubber printing rollers on a production basis, but which can also be employed as a standard engine lathe for a wide range of metal turning and finishing operations, has just been announced by the R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio.

The efficient roll grinding action of the machine at 4125 R.P.M. is obtained through a special variable-pitch drive which revolves the roller clockwise and a 2-H.P. motor which drives the grinding wheel at a speed of 2325 R.P.M. in the opposite direction. Special accessories are also provided for driving and supporting the roller.

This machine has a swing of 19 1/4 inches, and is made in any bed length from 6 feet up. 95

Bradford Grinders and Buffers

The Bradford Machine Tool Co., 657 Evans St., Cincinnati 4, Ohio, is bringing out a new line of "Metalmaster" bench and pedestal type grinders and buffer-polishers equipped with 1 H.P., 110- to 220-volt, 50- to 60-cycle, single-phase motors. These new machines, known as the 190 series, are designed for shops and maintenance departments having single-phase electric power supply.

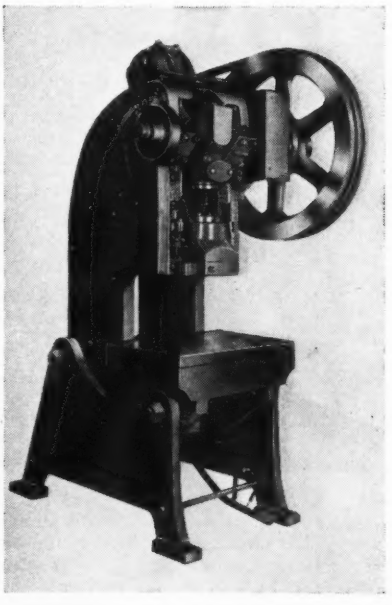


Bradford Double-wheel Pedestal Grinder

The eleven tool models making up the 190 series include a double-wheel pedestal grinder and a combination grinder and buffer on a pedestal mount. Both of these machines have a wheel diameter of 12 inches and are available with bench type bases. Seven buffers are also included in the series, among which are ball-bearing pedestal buffers having distances between wheels of 23 1/2, 31, and 39 inches. Each of these tools is available as a bench type model. The series also includes a low-stand ball-bearing buffer having a distance between wheels of 31 inches and a height of 37 inches from the floor to the center of the spindle. 96

Punch Press with Self-Energizing Brake

The Superior Punch Press Co., 3610 Superior Ave., Cleveland, Ohio, has brought out a new steel welded punch press in 70- and 100-ton capacities. One of the outstanding features of this press is the self-energizing brake, which increases the braking pressure until the crankshaft is brought to a stop. This action is synchronized with the clutch, so that when the clutch engages, the brake will automatically disengage. As a result, considerable power is saved and the life of the brake lining is greatly increased.



Punch Press with Self-energizing Brake

To obtain additional information on equipment described on this page, see lower part of page 226.

*A Hogging Demonstration.

HOGGING!

No shaper hogs off metal without power at the cutting tool or without rigidity or without an overall ability to stand the gaff.

Cincinnati Heavy Duty Shapers, outstanding for many years in power, stamina and sustained performance, are today more powerful and more rigid than before.

The reliable performance of Cincinnati Heavy Duty Shapers means profit in the shop.

Write for catalog N-3 on the complete line of Cincinnati Shapers.

*This Cincinnati Heavy Duty Shaper operated for the 10 days of the Machine Tool Show on a 2" depth of cut, .030" feed, and nine strokes per minute—in 1020 Steel to show the remarkable cutting capacity and rigidity of Cincinnati Shapers.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

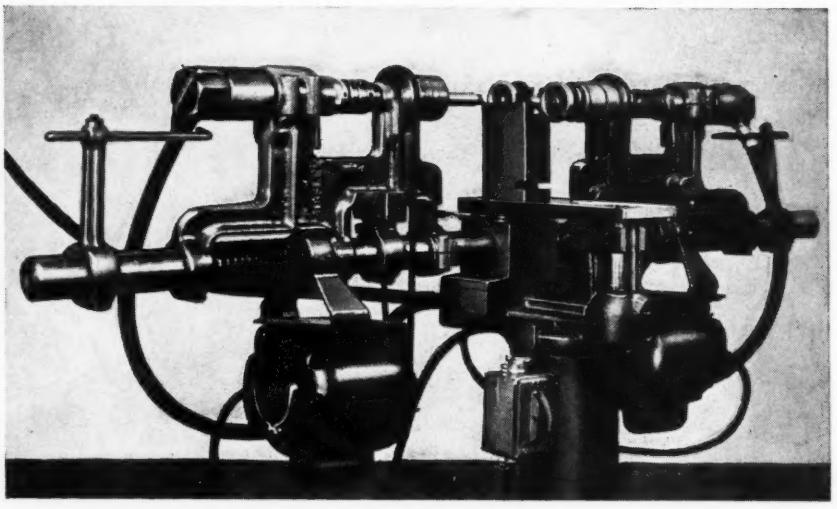
The clutch is cam-controlled, being mounted on the crankshaft that operates the throw-out yokes. This arrangement results in a positive action, and practically eliminates wear on the clutch parts.

The 70-ton press has 4 1/2-inch main bearings; a 6-inch connection bearing; standard stroke of 3 1/2 inches; bolster plate of 22 by 32 inches; and weighs 11,000 pounds. 97

Lemert Double-End Airflex Riveter

The Lemert Engineering Co., 1200 N. Western Ave., Plymouth, Ind., has brought out a horizontal double-end riveter employing the principle of rotating impact used on the company's vertical type riveter. Although originally designed for riveting both ends of a door-hanger axle simultaneously, as shown in the accompanying illustration, the new machine is adaptable to many other applications, such as the double-end riveting of fuse-box switch frame parts and the double-end riveting of toy train truck axles. It is suitable for riveting the wheels on the axle of any wheeled toy, especially where the axle has a shoulder on each end, and for simultaneously heading both ends of a tie-rod.

Operation of the machine is similar to that of the standard vertical type, both hammers being applied simultaneously when the foot-pedal is depressed. The gap between the two riveting hammers is easily adjustable. Four sizes of hammers are available. 98

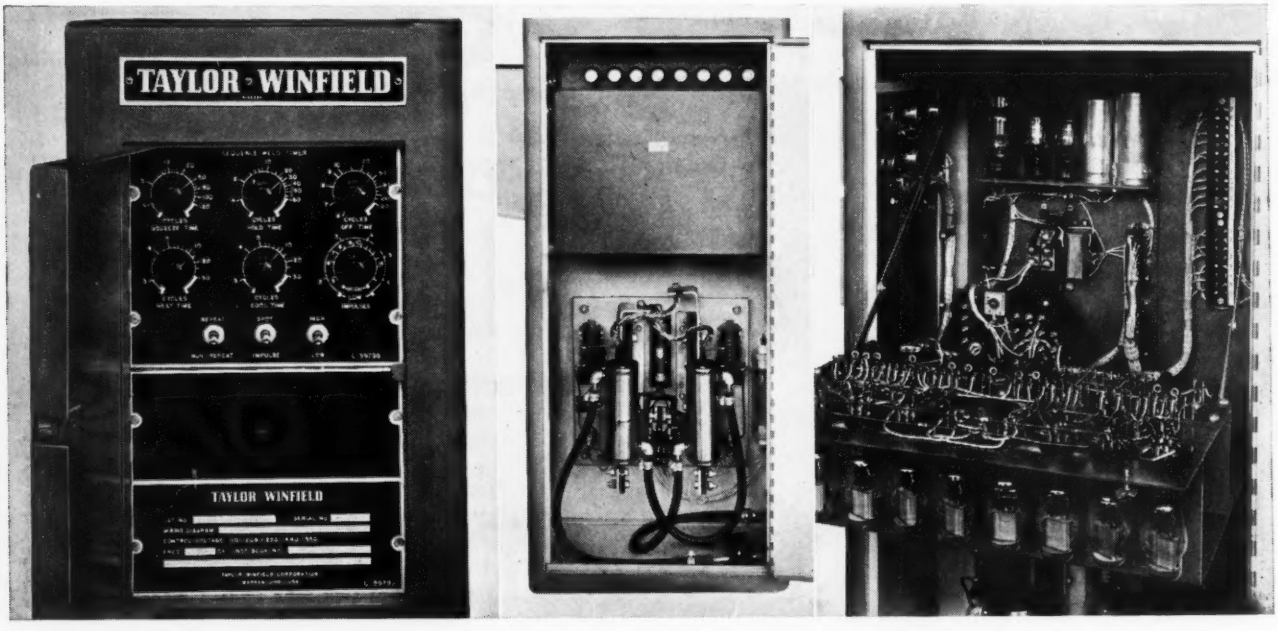


Lemert Double-end "Rotating Impact" Pneumatic Riveter for Heading Both Ends of Door-hanger Axle Simultaneously

Taylor-Winfield Coordinated Controls for Resistance Welders

The Taylor-Winfield Corporation, Warren, Ohio, has announced a new line of non-synchronous controls for resistance welders which are available for operation on single-phase alternating current. These units operate on power supply voltages of 208, 220, 380, 450, and 550 volts. They provide automatic and accurate control of the mechanical functions and the current flow as required for making uniform welds at high speed.

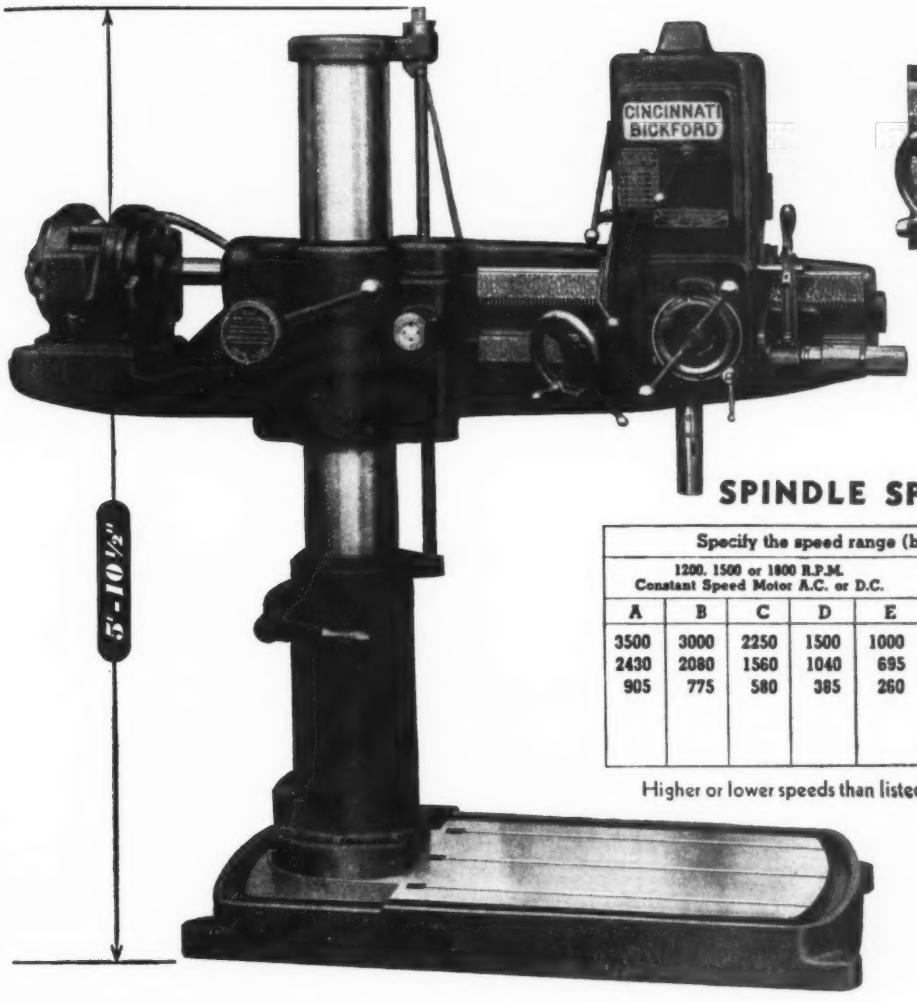
These controls are designed for use with foot-, air-, motor-, and hydraulically-operated spot, projection, butt, and seam resistance welders. They are enclosed in a steel cabinet. Timing is accurately controlled by graduated dials (as shown at the left in the illustra-

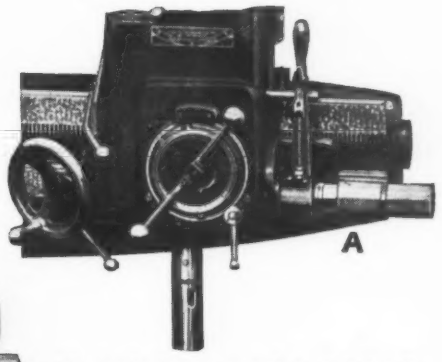


Taylor-Winfield Control Panel and Electrical Timing and Power Supply Units Developed for Resistance Welders

To obtain additional information on equipment described on this page, see lower part of page 226.

Safe...Simple...Speedy



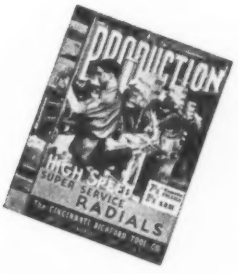


Hand wheel is operated by left handle, while right hand (grip A) controls advance and return of spindles and automatically controls direction of spindle rotation.

SPINDLE SPEED RANGES

Specify the speed range (by letter) that meets your needs									
1200, 1500 or 1800 R.P.M. Constant Speed Motor A.C. or D.C.					900/1800 R.P.M. or 750/1500 R.P.M. Two Speed A.C. Motor				
A	B	C	D	E	F	G	H	J	K
3500	3000	2250	1500	1000	3500	3000	2250	1500	1000
2430	2080	1560	1040	695	2430	2080	1560	1040	695
905	775	580	385	260	1750	1500	1125	750	500
					1215	1040	780	520	345
					905	775	580	385	260
					450	385	290	190	130

Higher or lower speeds than listed above are available on special order.



New distinctive features which reduce mass production costs are found in this simplified high-speed Cincinnati Bickford 7½" diameter, 2½' arm Super Service Radial.

You save in power, floor space, and in initial investment. You get a machine, that gives the operator maximum ease and speed in handling.

The machine is sturdy, and will give continuous high production.

Write for Bulletin R-26A. It is completely illustrated and gives a complete description.

THE CINCINNATI BICKFORD TOOL CO.
RADIAL AND UPRIGHT DRILLING MACHINES
SUPER SERVICE
Radials 7½" dia. col., 2½' arm, to 26" dia. col., 12' arm.
General purpose Uprights, 21" to 28" sizes.
Production Uprights, 21" to 28".
Jig Borers, Portable Horizontals, Spacing Table Machines.

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. **Cincinnati 9, Ohio U.S.A.**

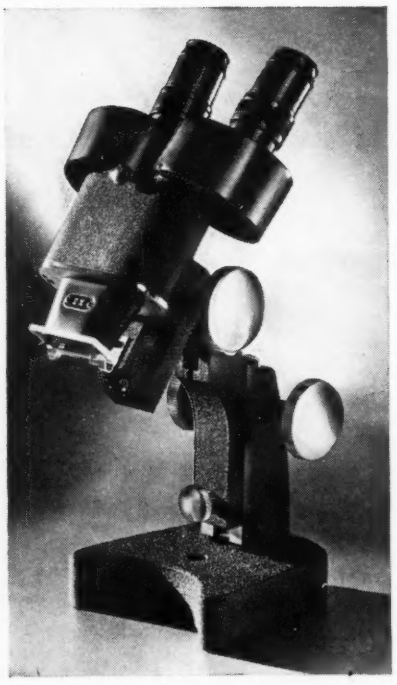
tion) which provide for a wide range of short-time settings. The timing dials are graduated in cycles for frequencies of 60, 50, and 25 cycles per second. Timers for pulsation welding have dials reading directly in the number of impulses desired.

Control units are readily accessible through the large side door of the cabinet, as shown in the center view of the illustration. The panels on which the components are mounted are designed to swing forward for checking or servicing, even while in operation, as shown at the right. 99

Bellows Non-Rotating Reciprocating Air-Motor

A new heavier and more powerful reciprocating, non-rotating air motor has been added to the line of air motors made by the Bellows Co., 222 W. Market St., Akron, Ohio. The valve and all operating controls are integral with the unit. The valve operating lever is adjustable to any convenient position. Easily adjustable controls regulate the speed of the piston.

The 4 1/2-inch bore of this motor develops a piston thrust of fifteen times the air-line pressure from any air line with a pressure up to 175 pounds per square inch. The motor is available with strokes of 1 1/2, 3, 6, and 9 inches, but any stroke can be had on special order. It is made in many different styles including pivot mount; remote-control pivot mount; solenoid operated; remote-control manually operated; and standard foot-mounted units...100



Industrial Microscope Made by the American Optical Co.

Spencer Stereoscopic Industrial Microscope

A new Spencer stereoscopic shop microscope, designed to expedite numerous industrial operations where minute details must be closely observed, is announced by the American Optical Co., Southbridge, Mass. The new microscope was developed by the company's scientific instrument division in Buffalo, N. Y., to improve quality control. It has been found exceptionally useful in performing such operations as drilling jet injectors, precision grinding, hand broaching, fine engraving, manufacture of watch escapements, small parts inspection, die-sinking, lens mounting, and many other toolmaking, fabricating, and inspection processes.

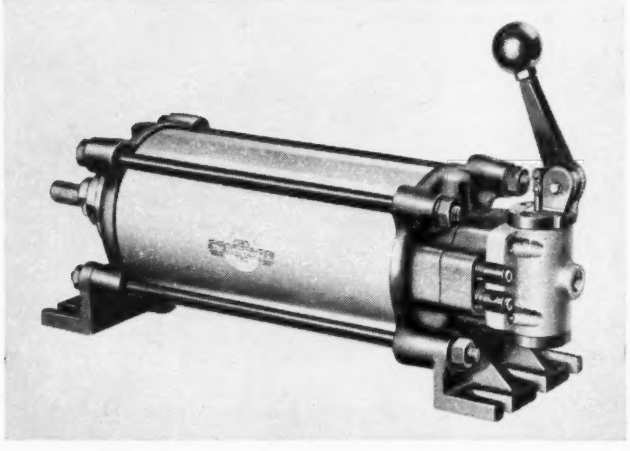
This shop microscope is supplied in powers of 9X, 18X, and 27X, and has a glass plate clipped to the front of the objective lens holder to prevent oil and metal chips from damaging the lens surfaces. It can be used in the conventional manner or bolted to a machine through a hole in the base, and it can also be attached to specially designed brackets.

The microscope's two eye-pieces are mounted according to the normal convergence of the eyes for close work, and are adjustable, thus permitting the instrument to be used for long periods of time without eye strain. 101

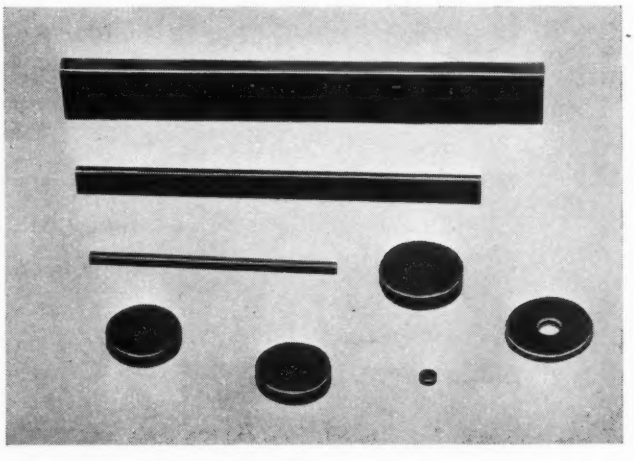
Disks and Strips of Cemented Carbide

Solid disks, disks with holes, and solid strips are now available in cemented carbide from the Carboloy Company, Inc., Detroit 32, Mich. The solid disks, which are furnished in ten sizes ranging from 1/8 inch in diameter by 1/16 inch thick up to 1 inch in diameter by 3/16 inch thick, are extensively used for wear-proof inserts in gages and tools.

The disks with holes, of which there are twelve sizes ranging from 1/4 inch outside diameter by 1/8 inch inside diameter by 0.030 inch thick to 1 1/4 inches outside diameter by 5/16 inch inside diameter by 0.060 inch thick, are being applied primarily in the making of small solid carbide slitting saws.



Reciprocating Air Motor Built by the Bellows Co.



New Carbide Disks and Strips Made by Carboloy Company

To obtain additional information on equipment described on this page, see lower part of page 226.

MADE TO ORDER . . . FROM STANDARD UNITS

Ex-Cell-O Way-Type Precision Boring Machines Offer Specialized Multiple Operation at Low Cost

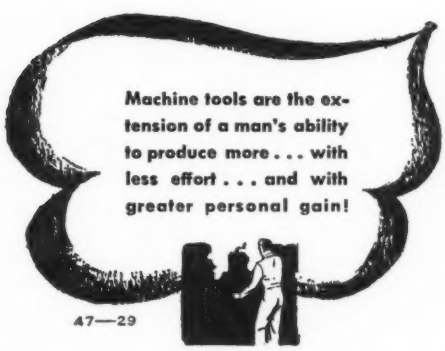
XLO

EX-CELL-O PRECISION

Illustrated here is an Ex-Cell-O Two Way Precision Boring Machine designed for boring holes in cast iron automotive transmission cases. To meet production requirements it was necessary to bore the holes at both ends at the same time.

Above: Special cluster spindles are required here because of close center distances of bored holes. Because boring bars at left are long and slender the ends are further lengthened to engage pilot bushings in the fixture.

Ex-Cell-O Way machines are made to order for work like that illustrated here. They are built up from standard way units that can be operated simultaneously or in sequence as the work requires. Way machines do the work of special machines, but the use of standard units keeps the first cost low and, as production requirements change, the units may be rearranged to accommodate different work. Ex-Cell-O One Way Precision Boring Machines are especially suitable for heavy or awkward work. Two Way Machines accommodate awkward and long work pieces and save time by boring from both sides simultaneously. Three and Four Way Machines are particularly suitable for boring holes perpendicular to one another. An important feature of Way Machines is that multiple operations are performed from the same work locating points, with only one handling of the parts.



EX-CELL-O CORPORATION

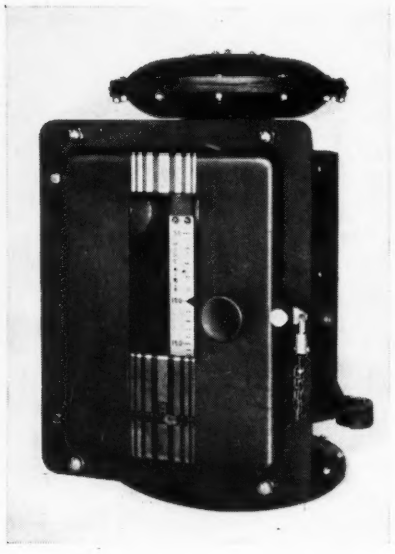
DETROIT 6 MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CONTINENTAL CUTTING TOOLS • MISCELLANEOUS PRODUCTION PARTS • FUEL INJECTION EQUIPMENT • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • PURE-PAK PAPER MILK BOTTLE MACHINES

The solid carbide strips are available in twenty-one sizes, ranging from 1/16 inch by 1/8 inch by 3 inches up to 1/4 inch by 3/4 inch by 6 inches. They are most widely used as wear-proof facings for work-rests of centerless grinding machines. 102

Leeds & Northrup Air-Fuel Ratio Controller

Simplicity, accuracy, and sensitivity are features of a new air-fuel ratio controller brought out by the Leeds & Northrup Co., 4924 Stenton Ave., Philadelphia 44, Pa. Like the "Micromax" pyrometers and Leeds & Northrup furnace pressure controllers with which it operates, the new con-



Leeds & Northrup Air-fuel Ratio Controller

troller employs motor-driven valves which require no hydraulic piping.

This controller is of rugged balanced type design having ample flexibility for any operating condition. The ratio can easily be adjusted manually for operation with fuels of various BTU contents. As the fuel flow changes, the instrument maintains a constant air-fuel ratio at the desired control point. It can also be used to provide automatic variation of the ratio, increasing or decreasing the per cent of air at reduced fuel flow. The instrument can be readily mounted on the furnace panel with the other control instruments. 103

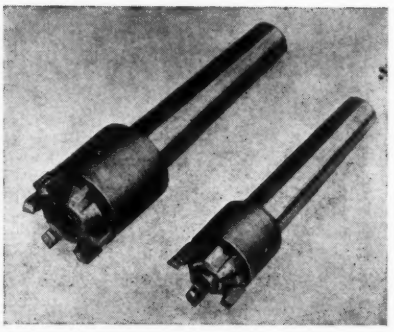


Fig. 1. Howald Adjustable-blade End-mills

Howald Carbide Milling Cutters

A line of carbide milling cutters designed especially to assure maximum life of the carbide blades is being marketed by the H. T. Howald Machine Works, 182 Sigourney St., Brooklyn 31, N. Y. The sharp blade lock used on the shell and face mills and the cone blade lock used on the replaceable blade end-mills of this new line provide a convenient means of replacing and making blade adjustments for setting or grinding operations.

The blades are of standard square stock without serrations or grooves. This feature permits the blades to be ground to any combination of angles prior to insertion in the cutter head. It also allows a minimum of material to be removed in resharpening, thus reducing the grinding time and assuring longer blade life. If desired, blades of cast alloy or high-speed steel can be used.

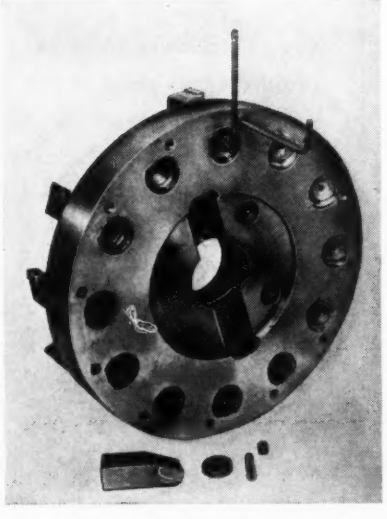
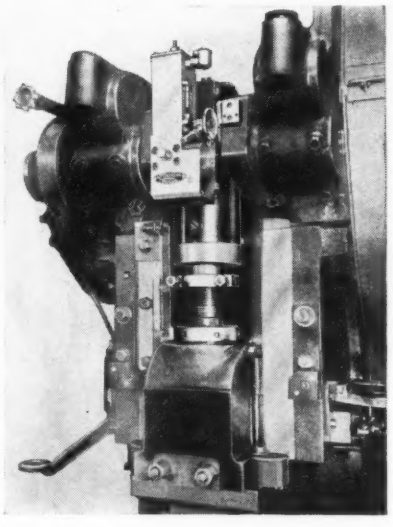


Fig. 2. Howald "Sharp Lock" Milling Cutter

The replaceable blade end-mills are especially suited for small milling jobs, and are made in sizes from 1 1/2 to 3 inches in diameter with four to six blades. The shell mills, for light or heavy duty, range from 3 to 6 inches in diameter and have six to twelve blades. The face mills, for heavy duty, are made in sizes from 8 3/8 to 14 inches in diameter, with ten to twenty blades. 104

Hydraulic Overload Jack and Connecting-Rod for Punch Presses

The Dayton Rogers Mfg. Co., 2835 Twelfth Ave., S., Minneapolis 7, Minn., has brought out a new hydraulic overload jack and

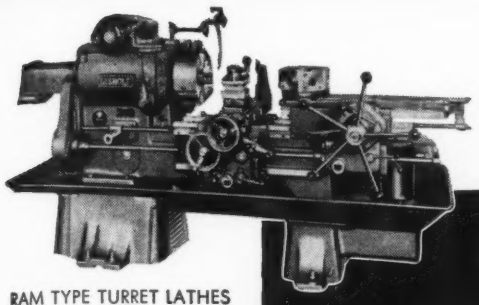


Punch Press Equipped with Hydraulic Overload Jack

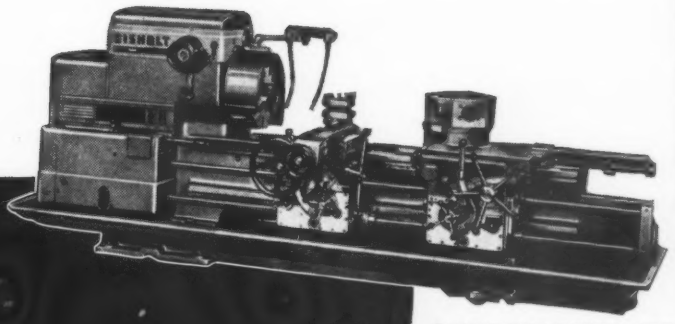
connecting-rod designed primarily for large single- and double-crank straight-side punch presses. This jack will prevent overloading of the press and damage to the crank and frame. It replaces the existing connecting-rod or strap, including the strap crankpin bearing and the adjusting screw, thus supplying a connecting link between the crank bearing and ram.

This arrangement protects the operator, and can be calibrated to protect the dies or tool equipment used for any specific press job. In case the press is overloaded beyond the predetermined pressure for which the hydraulic jack is set, the entire jack mechanism will telescope, allowing the press

To obtain additional information on equipment described on this page, see lower part of page 226.



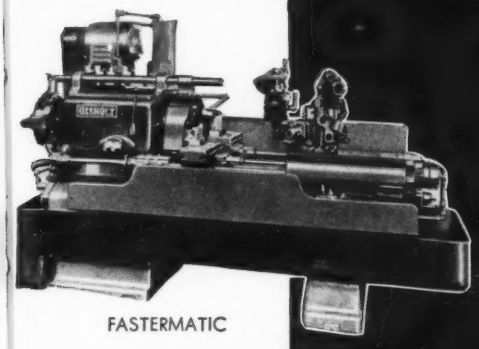
RAM TYPE TURRET LATHES



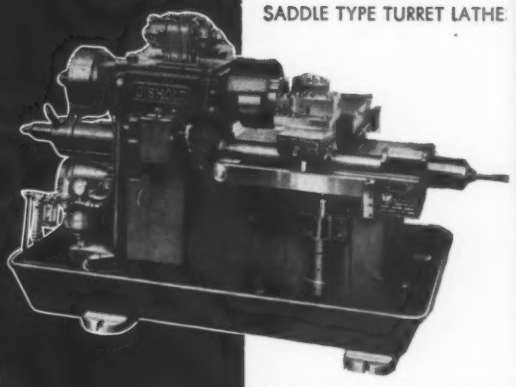
SADDLE TYPE TURRET LATHE

Which

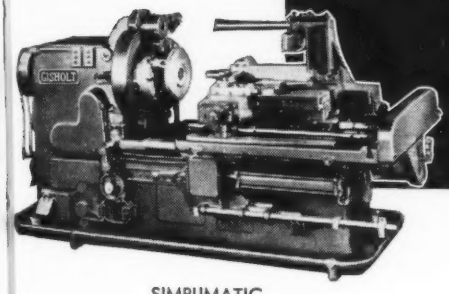
GISHOLT MACHINE for your Round Parts?



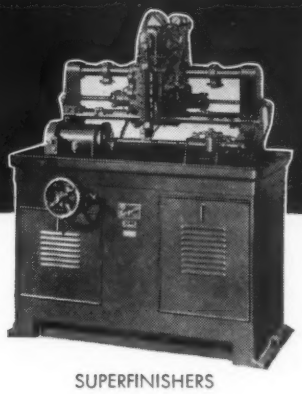
FASTERMATIC



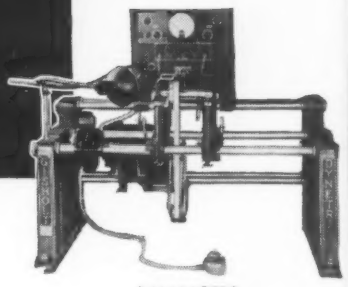
HYDRAULIC AUTOMATIC LATH



SIMPLIMATIC



SUPERFINISHERS



BALANCERS

If you're machining—or surface finishing—or balancing parts that are round, or partly round, the chances are that Gisholt can help you cut your costs.

It doesn't matter whether your parts are big or little—whether your volumes are large or small—Gisholt offers the right size and type of machine to answer your needs.

Meet us at the GISHOLT ROUND TABLE

Here at Gisholt you will find an organization that has specialized for over a half century on the production and refinement of round and partly round parts. Here is a group of specialists who can bring more experience to bear on your particular production problems. The Gisholt Round Table is a clearinghouse for practical ideas. Make use of it.

GISHOLT MACHINE COMPANY

Madison 3, Wisconsin

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing, and balancing of round and partly round parts. Your problems are welcomed here.

Look Ahead... Keep Ahead... With Gisholt

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

to continue the work cycle without damage to the tools or press. The jacks are made in sizes ranging from 50 to 500 tons working capacity. 105

Automatic Disintegrator for Removing Broken Taps and Drills

An automatic disintegrator that removes broken taps, drills, studs, and reamers from die sections, castings, hardened steel, brass, bronze, and almost any alloy metal parts without distortion or heating of the part from which the broken member is taken has been announced by the Ansaldi Tool & Engineering Co., 4744 Twelfth St., Detroit 8, Mich. Electrodes are used for removing the broken or obstructing pieces. Once an electrode is adjusted in the proper position, the disintegrator operates without further attention. Thus one man can keep four or five disintegrators operating at one time.

Broken taps up to 1 inch in diameter are easily removed by this method, an ordinary 1/2-inch tap being disintegrated in seven or eight minutes. Electrodes several feet in length are available for deep-hole operations. The disintegrator is of the revolving head type, which can be swiveled to any angle, and can be used horizontally or upside down. 106

Ansaldi Disintegrator Undergoing Adjustment preparatory to Automatic Operation

Ruthman Coolant Pump

Twin inlets so arranged as to provide hydrodynamic balance and thus eliminate end thrust are a feature of a new coolant pump placed on the market by the Ruthman Machinery Co., Cincinnati 2, Ohio. All rotating parts of this pump are dynamically balanced by an electronic process. The pump can handle liquids containing reasonable amounts of grit and abrasives, as there are no metal-to-metal contacts within the submerged portion. The pump motor is of the totally enclosed type and

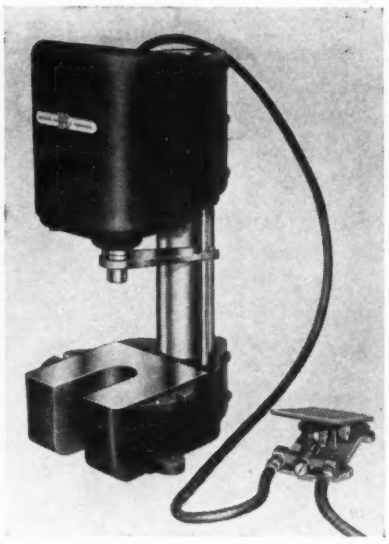
Ruthman Coolant Pump for Machine Tools

utilizes precision sealed prelubricated ball bearings, thus eliminating the need for oilers or grease fittings.

The capacity of this pump at a 26-foot head is 40 gallons per minute with a 1/2-H.P. motor, and 60 gallons per minute with a 3/4-H.P. motor. 107

Bryant Air-Hydraulic Forming, Riveting, and Assembling Press

A new air-hydraulic press for light forming, riveting, and assembling operations has been brought out by Bryant Products Co., Jackson, Mich. The ram speed of this press can be varied from



Air-hydraulic Forming, Riveting, and Assembling Press Brought out by the Bryant Products Co.

1 to 40 strokes a minute, with fast return regardless of the cycle speed. The pressure is controlled by a valve in the supply line. Standard controls include a three-way hand or foot-valve and an air-line regulator valve. A solenoid valve provides for automatic operation of the press and also controls the length of the press stroke.

This press is built in three sizes. The small model, shown in the illustration, exerts a pressure of 900 pounds on the down stroke and 70 pounds on the up stroke; the intermediate size exerts a pressure of 2500 pounds on the down stroke and 275 pounds on the return stroke; and the largest size exerts a pressure of 5000 pounds on the down stroke and 500 pounds on the return stroke. 108

Alnico Magnet Holding Assemblies

A new line of Alnico permanent-magnet holding assemblies that combines minimum space requirements with maximum holding power has been announced by the Metallurgical Division of the General Electric Co., Pittsfield, Mass. The smallest of the holding assemblies is the cup type, which is available in four sizes ranging from 9/16 to 29/32 inch in diameter, with pulls of 1 1/2 to 12 pounds. By replacing the brass eyelet of the cup assembly with an aluminum stem 3 to 6 inches long, a "cup-stem" type assembly

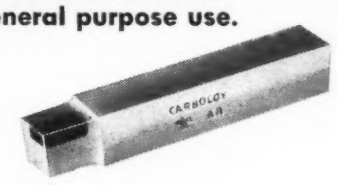
To obtain additional information on equipment described on this page, see lower part of page 226.

Now! MORE THAN *600* CARBOLOY® STANDARDS

CEMENTED CARBIDE

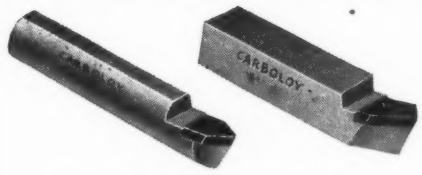
. . . FOR MAXIMUM RESULTS WITH CARBIDE TOOLING

. . . OVER 80 STANDARD TOOLS!
for general purpose use.



One of 11 standard sizes

. . . OVER 60 STANDARD BORING TOOLS!



two of the 7 styles available

. . . OVER 180 STANDARD BLANKS!
for cutting tools.

A few of the many shapes available

. . . OVER 300 STANDARD WEAR—RESISTANT BLANKS!

typical examples of available shapes

Looking for ways to increase production . . . to reduce manufacturing costs . . . to meet and beat Today's competition.

HERE'S THE ANSWER . . . get greater carbide tool effectiveness . . . with the greater advantages you get in low-cost Carboloy "Standards."

More than 600 Carboloy "Standards" . . . cutting tools and blanks . . . ready for instant use . . . are "on-the-shelf" . . . stocked for *speedy delivery* by local distributors in 74 cities coast-to-coast. Why not look into the unusual benefits in Carboloy Cemented Carbides . . . get maximum results through greater carbide tool advantages.

Have you seen the *New* 1948 Carboloy Tool Catalog—just published? This 64-page illustrated catalog . . . most comprehensive in the cemented carbide industry . . . is literally packed with cost-cutting "Standards" and their applications . . . a veritable abundance of Carboloy Cemented Carbides to handle 60%—80% of your machining needs. Send for your FREE copy TODAY! Carboloy Company, Inc. 11147 E. 8 Mile Street, Detroit 32, Michigan.

AUTHORIZED CARBOLOY CEMENTED CARBIDES DISTRIBUTORS

Standards are stocked in 74 cities coast-to-coast

CARBOLOY

CEMENTED ® CARBIDES

is obtained that is applicable in machine shops or laboratories for holding dial indicators.

Another assembly is the horseshoe type, which was designed as an all-purpose device. Available in four sizes and exerting pulls of 15 to 200 pounds, these assemblies can be used for overhead conveyor work or for holding tracks for automatic burning and welding equipment.

Other models include the "magnetic retriever" used to recover steel and iron parts that have dropped to the bottom of deep tanks during plating operations; and the deep-flux magnetic stand, the primary application of which is for holding ring stands or dial-indicator supports on steel working surfaces. 109

New Milling Cutters with "Bi-Axial" Grind

Solid-carbide inserted-blade milling cutters, especially ground for making heavy side and face milling cuts, have been developed by the Super Tool Co., 21650 Hoover Road, Detroit 13, Mich. These cutters are ground bi-axially, having a combination of negative radial and two negative axial rake angles. This has a "centering" effect on the cutter, stabilizing the pressure and eliminating "flutter." As a result, improved finish and longer cutter life are obtained. In addition, the amount of work per grind has been more than doubled on some applications. 110

High-precision Gage-blocks Made by Taft-Peirce Mfg. Co.

Taft-Peirce High-Precision Gage-Blocks

The Small Tool and Gage Division of the Taft-Peirce Mfg. Co., Woonsocket, R. I., has announced a new set of high-precision "A" accuracy gage-blocks. These gage-blocks are hardened and seasoned to insure durability and accuracy. Each set contains a complete assembly of eighty-one standard sizes, as well as an additional 0.10005-inch block. The size of each block is plainly marked on the edge for quick identification and easy selection. 111

Wright "Speedway" Electric Hoist

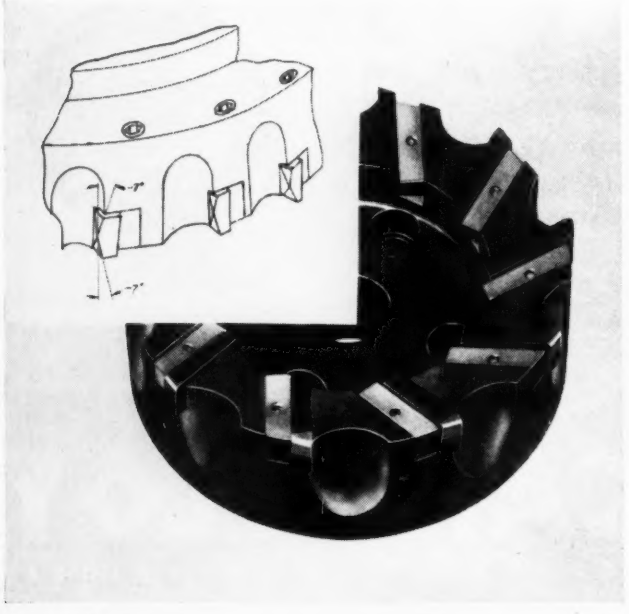
The Wright Hoist Division of the American Chain & Cable Co., Inc., York, Pa., is introducing a new line of "Speedway" electric hoists built in capacities of 250 to 2000 pounds. This hoist has a grooved drum which accommodates a full 12-foot lift with no over-winding; pre-formed wire rope with wedged fittings for anchoring; Timken tapered roller bearing trolleys which permit moving loads along runway beams with a minimum of effort; and standard NEMA motor ratings.

The hoist is furnished with lug, hook, or trolley suspension, as required. All hoists equipped with trolleys have a special pull chain and handle for moving the hoist along runway beams. 112

Horizontal Type Wet-Dry Belt Surfacing Machines

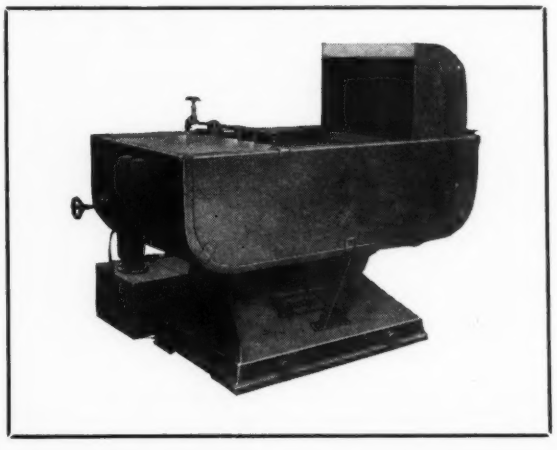
The Production Machine Co., Greenfield, Mass., has recently developed 14-inch and 20-inch horizontal type wet-dry belt surfacing machines. The 20-inch machine illustrated has an available operating surface on the work-table of 20 by 30 inches, which provides an ample area for oscillating large and small parts.

Work-stops with adjustments for handling all types of parts are provided. The standard belt surface speed is 4600 feet per minute, but other speeds can be made available. The coolant recirculating system has a centrifugal pump mounted on a tank of 32-gallon capacity. The machine is equipped with a 10-H.P. main drive motor and a 1/4-H.P. pump motor having magnetic starter



(Left) Milling Cutters with "Bi-axial" Grind Made by Super Tool Co.

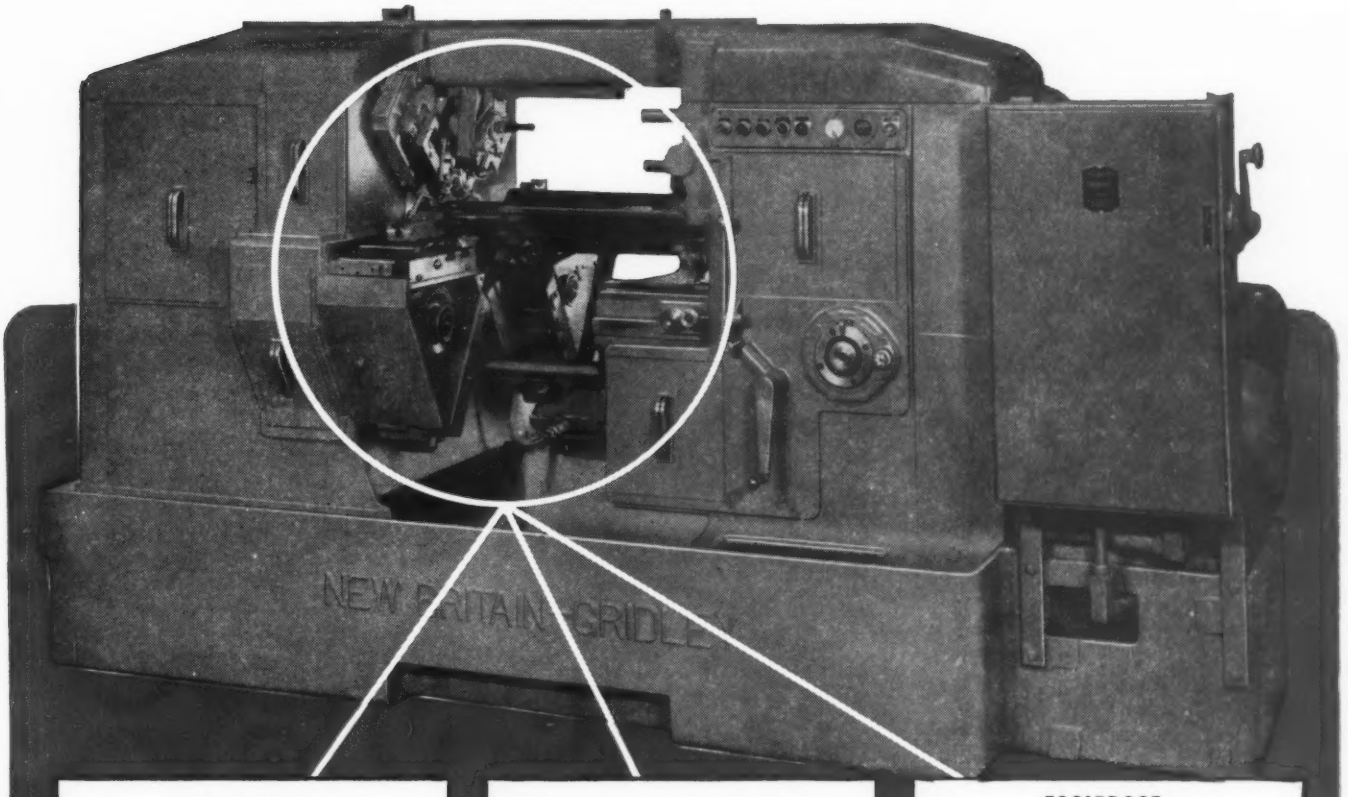
(Below) Wet or Dry Belt Surfacing Machine Developed by the Production Machine Co.



To obtain additional information on equipment described on this page, see lower part of page 226.

NEW BRITAIN'S NEW LINE OF SCREW MACHINES

Answers the Need for Lower Costs and Higher Productivity



QUICK SET UP

1. No cam to change for main tool slide. Strong, positive universal cam selects feed stroke without changing high point, stops or total stroke.
2. No cam to change when adjusting stock feed-out length.
3. Cross slide cams directly behind slides minimizing linkage. Remove three screws with cover and cams pull off.
4. Micrometer adjustment in both directions on all cross slides, all independent of stops.

SYMMETRICAL RADIAL TOOLING

1. Five heavy-duty forming slides and cut off slide evenly spaced about carrier making line of forming thrust identical in each position.
2. Tool holders interchangeable among forming slides, also on main tool slide.
3. Greatly increased chip clearance and capacity, so essential with carbides.
4. Flexibility for auxiliary threading attachments. Accelerating drives in every position.

FOOLPROOF, AUTOMATIC OPERATION

1. Shoulder height, complete control panels at front and rear of machine.
2. Automatic stop shuts off machine and flashes red light when spindle is empty.
3. Program wheel on outside of powercase shows complete cycle of machine.
4. Machine stops if lubricating oil pressure is low.
5. Gage indicates when machine is operating at other than normal load.

Fast, powerful machines which will outperform anything modern tools will handle and anticipate future tool developments. These new machines with their initial and permanent accuracy also incorporate all the previous exclusive features by which NEW BRITAINS are recognized. To these qualities have been added new features, making it possible to accomplish quick setups where short runs are the rule. Built massive to handle the horsepower required for steady feeds for carbides on tough forming steel jobs, they are also designed for super high-spindle speeds, essential for brass and aluminum. Six spindles up to 2¼" capacity.

M-01062

THE NEW BRITAIN MACHINE CO.

NB

NEW BRITAIN

Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

and push-button control. It occupies a floor space of 61 1/4 by 86 3/8 inches, and weighs 2600 pounds. 113

Rotary Stock Stops for Automatics and Turret Lathes

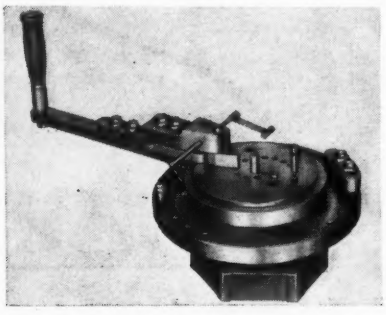
A complete line of rotary stock stops for automatic machines and turret lathes is announced by the

Barnaby Rotary Stock Stops

Barnaby Mfg. & Tool Co., 70 Knowlton St., Bridgeport 8, Conn. These stops are available in eight sizes with shank diameters from 5/8 inch to 2 inches. The stops are furnished with either plain ends or center holes for burrs. The smaller sizes can be provided with a full-diameter or a small nose, as shown, to avoid interference with cross-slide tools. 114

Di-Acro Precision Multi-Purpose Bending Machine

A new Model No. 1A Di-Acro bender capable of forming bends of large radii in light-weight materials at high production rates has been added to the line of the O'Neil-Irwin Mfg. Co., 332 Eighth Ave., Lake City, Minn. This bender has all the construction and operating features of the regular line of Di-Acro benders, including Torrington roller bearings, which assure easy, speedy operation.

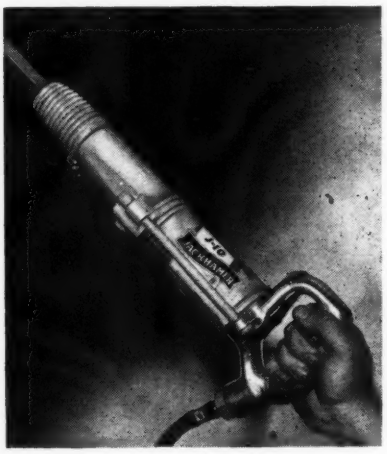


Di-Acro Bending Machine

It will form and duplicate an unlimited variety of parts and pieces. Also it can be used for producing formed pieces having shapes impossible to obtain with regular production bending dies. All types of ductile metals, such as round, half-round, hexagonal, and square rod, tubing, angles, channels, molding, and strip stock, can be handled. 115

Air-Operated "Utility Jackhamer"

An air-operated drill designed for general utility and plant maintenance work is a recent development of the Ingersoll-Rand Co.,



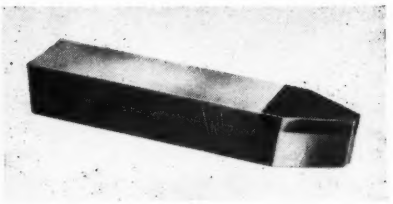
Ingersoll-Rand Air-operated "Utility Jackhamer"

11 Broadway, New York 4, N. Y. This new rock-drill type tool, known as the "Utility Jackhamer" has a strong automatic rotational movement and uses standard "Jackbits."

By employing adapters, star drills can be used to drill holes up to 1 1/8 inches in diameter. Removal of the rotation pawls or the use of round-shanked tools adapts the drill for chiseling and channelling. Throttle control permits selecting just the right blow capacity for any job. 116

Wendt-Sonis Carbide-Tipped Tools

A new carbide-tipped tool for production grooving has been developed by the Wendt-Sonis Co., Hannibal, Mo. This tool is de-



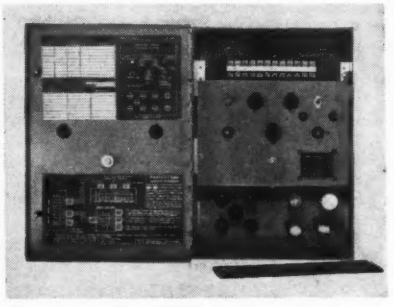
Wendt-Sonis Carbide-tipped Tools for Finishing Pulleys

signed for machining A, B and C belt size pulleys. Nose widths and angles are held to close tolerances for accurate production of the finished pulley.

Standard tools are furnished with the proper grade of carbide inserts for the material to be machined, and the shanks are hardened and treated to prevent rusting. The carbide tips are covered with plastic to prevent chipping from handling. These grooving tools are manufactured in shank sizes ranging from 5/8 by 1 inch to 1 inch square. 117

Device for Protecting Tools, Dies, and Machines from Damage

The Brinnell Co., Granby, Conn., is manufacturing an electronic device called the "Protectron" for use with an electric motor driven machine to protect it from damage due to overloads. The device "trips" the drive at any predetermined point where the load rises above that of the normal mechanical load. It is designed for instantaneous action, is sensitive to minute overloads, adjustable to any degree of overload within practical limits, and automatically compensates for fluctuations in terminal voltage. When the Protectron acts, a red warning light is illuminated, and a relay is energized to initiate any desired con-



Device for Protecting Machines from Damage, Made by Brinnell Co.

To obtain additional information on equipment described on this page, see lower part of page 226.

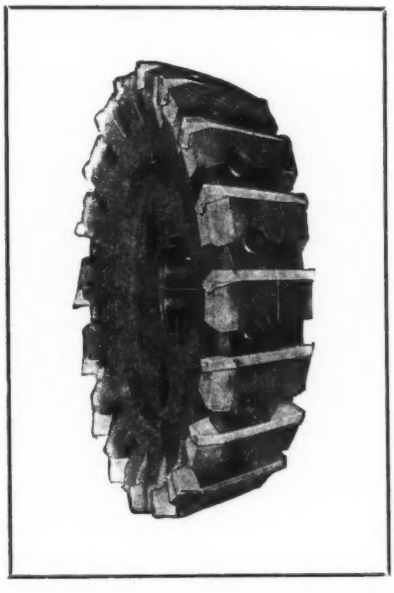
trol function through auxiliary equipment. It can be used to stop the motor, stop the machine by operating the clutch or the clutch and brake, increase or decrease voltage on the motor, sound warning signal, etc.

The Protectron is available in two models for operating currents of 1 to 5 amperes and 5 to 10 amperes. Special models for higher currents can be obtained. 118

"Axial Face Kennamill" Cutter for Production Milling of Cast Iron

Kennametal, Inc., Latrobe, Pa., has just introduced an "Axial Face Kennamill" cutter designed especially for production milling of cast iron, which is suitable for taking light to medium cuts on solid or cored castings. The new cutter incorporates the advantages of solid-blade face milling cutters with the maximum number of blades. It can be easily set up, since it is possible to assemble the blades within a few thousandths inch on the face and periphery, and then clamp them securely in place.

Sharpening is simplified because of the open construction of the cutter, and freedom from brazing strains, and because there are only three surfaces to be ground. The cutter can be mounted on all commonly used spindles, with the bolt hole circle laid out to the user's specifications. The body is shaped to permit grinding a 45-degree corner angle for milling light cored section. Five sizes ranging from 6 to 14 inches in diameter are now available. 119



"Axial Face Kennamill" Cutter

Van Keuren Microgages

The Van Keuren Co., 178 Waltham St., Watertown, Mass., has introduced on the market a new set of microgages designed for setting large micrometers. The set includes 1-, 2-, 3-, 4-, 5-, and 6-inch microgages, which are 7/8 inch in diameter. Microgages up to the 1-inch size are held to a tolerance of plus twelve millionths inch and minus eight millionths inch, or a total tolerance of twenty millionths. The microgages from the 2- to 6-inch sizes, inclusive, are held to a total tolerance of fifteen millionths inch per inch of gage length.

Van Keuren Microgages for Setting Large Micrometers

The 7/8-inch diameter provides the required rigidity for the long gages and also furnishes a large surface area which assists in holding long combinations of gages together. The body diameters are ground to a true cylindrical shape. Combinations of these gages can be used for lengths up to 21 inches. 120

Miller Hydraulic Pump

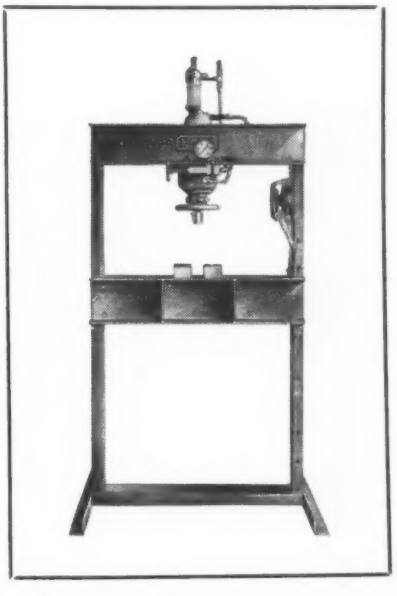
The Miller Hydraulic Engineering & Sales, 3615 Hart, Detroit 14, Mich., has announced a new four-piston hydraulic pump weighing only 30 pounds, which will operate in either direction of rotation. This pump is designed for easy installation wherever any standard hydraulic pump can be employed. The four pump pistons are horizontally opposed. Hardened steel throws are keyed to the driveshaft. The one-piece forged-bronze connecting-rods have ball-bearing ends which take the pumping load on the inside of the piston dome. Relief valves incorporated in the pump are set at the factory for the desired operating pressure.

Miller Four-piston Hydraulic Pump

At 1200 R.P.M., the discharge pressure ranges from 0 to 3000 pounds per square inch, and the delivery from 5.4 to 3.0 gallons per minute. The four cylinders provide a discharge flow having a minimum of pulsation. The discharge pressure is practically independent of driving speed. 121

Dake Air-Operated Presses

A new series of air-operated presses, available in capacities of 25, 50, and 75 tons, has been brought out by the Dake Engine Co., Grand Haven, Mich. These



Dake Air-operated Press

To obtain additional information on equipment described on this page, see lower part of page 226.

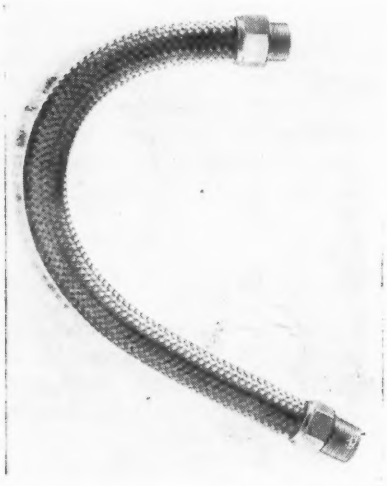
presses are suitable for general manufacturing plants or for tool and die shops.

The new presses are available with two styles of pumps. One style provides the rated tonnage of the press at 145 pounds per square inch air pressure; the other provides the rated tonnage at 90 pounds per square inch air pressure. The press is equipped with a special safety valve to prevent overloading regardless of the pressure, and an optional control is available that can be regulated to provide air pressure lower than that in the lines. 122

Titeflex Flexible Metallic Tubing

Flexible metallic tubing made from Monel metal for use where severe corrosion or high-temperature conditions are encountered has just been announced by Titeflex, Inc., 519 Frelinghuysen Ave., Newark 5, N. J. This new Monel metal tubing is recommended for applications where the corrosion resisting requirements cannot be readily met by brass tubing, or where the operating temperature is around 300 degrees F. This tubing resists the attack of mineral and organic acids, alkalies, and salts over a wide range of cencentration and exposure conditions. It is supplied for use in four temperature ranges, the range being determined by the melting point of the solder used in the seam of the inner core. The complete range of the four different solders is from 358 to 1785 degrees F.

Because of its suitability for high-temperature operations, Titeflex Monel metal tubing can be used in both high- and low-pressure steam lines. 123



Titeflex Metallic Tubing

Hydraulic Indexing Table for "Multipress"

A completely self-contained six-station index-table, designed for use with the "Multipress" or "Multi-Unit" press, but applicable to any equipment where hydraulic power is available, has been announced by the Denison Engineering Co., 1160 Dublin Road, Columbus 16, Ohio.

This new index-table operates directly from the hydraulic system of the press with which it is used. The action of the table is interlocked and positive. The ram cannot descend while the table is in motion, and the table will not rotate until the ram has completed its cycle. The dial of the index-table is actuated by the Denison "HydrOILic" fluid motor through a conventional Geneva mechanism. The fluid motor is equipped with speed control regulation, which permits ten to seventy indexing movements per minute. When used with the "Multipress," the action of the table and press is completely automatic, allowing the operator to stand well away from the press ram for maximum safety.

Hydraulic Indexing Table Developed for "Multipress"

Provision has been made to permit a "through" punching operation at a station spaced 120 degrees each side of the pressing station. Air blast or mechanical knock-out ejection of the work can be employed. There is also provision for employing "skip station" operation when desired. This feature can be used to advantage on short production runs or where the tooling size restricts the number of dial stations that can be employed. 124

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in December, 1947, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 230 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the December, 1947, Number of MACHINERY

Heat-Treating Equipment and Methods

SURFACE COMBUSTION CORPORATION, Toledo 1, Ohio. 32-page booklet entitled "Heat for Metals," covering the latest developments in heat-treating equipment and methods, including descriptions of standard industrial furnaces and burner systems. Copies can be obtained if requested on a company or professional letterhead addressed to the Surface Combustion Corporation.

Automatic Transfer Processing Machines

GREENLEE BROS. & CO., Rockford, Ill. Bulletin describing typical applications of Greenlee automatic transfer multiple-spindle drilling, boring, and tapping machines. Production figures and operation charts are included. Copies can be obtained if requested on a company letter-head addressed to Greenlee Bros. & Co.

Recommendations for Carbide Milling and Grinding

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio. Booklet M-1614, giving recommendations designed as a guide to efficient carbide milling practice, based on extensive metal-cutting research and on actual practice. Booklet M-1608, containing recommendations for grinding carbide milling cutters. 1

Gear and Jig Grinders

PRATT & WHITNEY DIVISION NILES-BEMENT-POND CO., West Hartford 1, Conn. Circular 496, containing a complete description, including specifications, of the new Pratt & Whitney 26-inch hydraulic vertical spur and helical gear grinder. Circular 500, illustrating and describing the company's No. 2C all-electric jig grinder.....2

Motor-Driven Screwdrivers and Attachments

RUMAC MFG. CO., 615 N. Michigan Ave., Chicago 11, Ill. Bulletin 17, illustrating and describing the Lead-All motor-driven screwdriver and screwdriver attachments. Leaflet containing specifications covering the new "Flex-O-Tension" flexible extention shaft for use with the Lead-All power-driven screwdriver.....3

Electric Cords

KOILED KORDS, INC., New Haven 14, Conn., P.O. Box K, Hamden. Circular showing various applications of a new retractile spiral-shaped electric cord that can easily be extended and retracts itself; designed for use on machines and appliances or wherever this type of electric cord is advantageous.....4

Rust-Preventive Use Chart

NOX-RUST CHEMICAL CORPORATION, 2483 S. Halsted St., Chicago 8, Ill. Chart showing the proper "Nox-Rust" compound to be used for rust prevention in fourteen specific cases. The chart also gives information on the degree of protection afforded, application and removal of the rust compound, and other useful data. 5

Texrope Drives

ALLIS-CHALMERS MFG. CO., Milwaukee 1, Wis. 144-page indexed catalogue on "pre-engineered" Texrope drives, containing engineering data that simplifies the selection of the proper drive for any particular application. More than 22,000 stock drives are listed for all applications ranging from 1 to 150 H.P. 6

Shielded Arc-Welding Equipment

AIR REDUCTION SALES CO., 60 E. 42nd St., New York 17, N. Y. Folder describing three new types of "Heliweld" equipment, including a manual holder, a machine holder, and an electronically controlled automatic head for use in inert-gas-shielded arc-welding operations. 7

Belt Grinding and Polishing Machines

HILL-ACME CO., 6400 Breakwater Ave., Cleveland 2, Ohio. Circular descriptive of Hill two-roll vertical abrasive-belt grinding and polishing machines for flat surfaces, made in three types for handling sheets, bars, and strips. 8

Mallets and Bench Vises

ACME TOOL CO., 71 West Broadway, New York 7, N. Y. Circular giving specifications, including prices, covering Nupla mallets with interchangeable tips of soft, medium, and tough grades. Bulletin on precision bench vises with interchangeable reversible jaws, for light or heavy duty.....9

Industrial Power Brushes

OSBORN MFG. CO., 5401 Hamilton Ave., Cleveland 14, Ohio. Catalogue containing 76 pages of data on the Osborn complete line of wire and fiber wheel brushes, paint and varnish brushes, and maintenance brushes; includes many illustrations of industrial brushing operations. 10

Self-Opening Die-Heads

GEOMETRIC TOOL CO., New Haven 15, Conn. Bulletin DS-3, illustrating and describing the new Geometric convertible self-opening die-heads for use on Brown & Sharpe and other single-spindle automatics, as well as on hand screw machines. 11

Ball Bearings

FAFNIR BEARING CO., New Britain, Conn. Catalogue on Fafnir super-precision ball bearings and their application in spindles, workheads, boring heads, live centers, etc. Data on mounting, preloading, lubrication, dimensions, and load ratings are included. 12

Precision Tap Sharpening

EDWARD BLAKE CO., 634 Commonwealth Ave., Newton Centre 59, Mass. Bulletin 647, entitled "Precision Tap Sharpening on the Blake Flute Grinder," containing technical information, including tables of settings for grinding flutes and spiral points. 13

Hydraulic Pumps

SUNDSTRAND MACHINE TOOL CO., HYDRAULIC DIVISION, 2531 Eleventh St., Rockford, Ill. Circular listing the outstanding features of the new Sundstrand constant-displacement, hydraulically balanced pump, and giving performance characteristics. 14

Metal Powders

NEW JERSEY ZINC CO., 160 Front St., New York 7, N. Y. Circular descriptive of the line of metal powders produced by the company, including brass, copper, bronze, and zinc powders, for use in making pressed powder parts and for other purposes. 15

Multiple-Spindle Heads

HOEFER MFG. CO., INC., Freeport, Ill. Circular showing the completely remodeled plant of the company and some of the new equipment installed for making drilling machines and multiple-spindle heads, typical examples of which are illustrated. 16

Grinding Wheels

CONTINENTAL ABRASIVE WHEEL CORPORATION, 1210 E. 55th St., Chicago 15, Ill. Circular listing over 230 standard sizes of cylindrical grinding wheels, diamond wheels, pedestal and bench grinder wheels, and polishing wheels available for immediate delivery. 17

Instructions on Brazing Carbide

ADAMAS CARBIDE CORPORATION, 1819 Broadway, New York 23, N. Y. Booklet entitled "Braze and Save," giving complete instructions on how to braze tungsten carbide with maximum efficiency and economy. 18

Nickel and Nickel-Alloy Tubing

SUPERIOR TUBE CO., 2196 Germantown Ave., Norristown, Pa. Catalogue Section 10, containing engineering data on nickel and nickel-alloy tubing of value in selecting the most suitable type for a specific application. 19

Rotary Hole Saws

MISENER MFG. CO., INC., 202-8 Walton St., Syracuse, N. Y. Pamphlet entitled "The Hole Story" describing the many uses of Misener single- and multiple-cut rotary hole saws suitable for use on metals, wood, plastics, and other materials. 20

Hydraulic Presses

AIR - HYDRAULICS, INC., 401 Broadway, New York 13, N. Y. Bulletin illustrating the various types of hydraulic presses and accessories made by the company. Typical jobs, showing the wide range of work performed, are illustrated. 21

Hydraulic Power Unit

JOHN S. BARNES CORPORATION, Rockford, Ill. Catalogue illustrating and describing the Barnes new "Rapidraulic" power unit, designed particularly for clamping and similar applications; includes operating instructions.....22

High-Pressure Hydraulic Die-Casting Machines

CLEVELAND AUTOMATIC MACHINE CO., Cincinnati 12, Ohio. Bulletin illustrating and describing the Cleveland Model 400 universal high-pressure hydraulic die-casting machine. 23

Circular Graduating Machine

ABRASIVE MACHINE TOOL CO., East Providence 14, R. I. Bulletin descriptive of the company's new circular graduating machine designed to accurately and quickly graduate handwheels, dials, knobs, and similar parts. 24

Welding Tips

KEATON MFG. CO., Box 220, Butler, Wis. Folder containing complete information on a new

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (December, 1947) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

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How We Beat Rising Costs by Changing to Welded Design

By Francis M. Wick, General Manager
Silver Manufacturing Company, Salem, Ohio

DESPITE the fact that costs have greatly increased in the past two years, the material costs of our "Ohio" Feed Cutter (Fig. 1) are no more today than on V-J day, due to the savings we have gained by changing to welded steel design.

The change to welded steel has also cut the machine's weight 24%, from 455 to 345 pounds—really a price decrease, since most of our sales are to foreign customers who pay duties assessed on basis of weight.

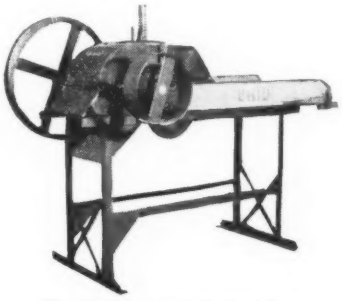


Fig. 1. The "Ohio" Feed Cutter.

We originally started experimenting with welded steel design because of the difficulty of getting a regular flow of parts. Our welding department has not only eliminated production bottlenecks, but has enabled us to increase production 79% with only a 20% increase in employees. The chief reason for this is that the parts of welded steel require much less machining, grinding and fitting than the former material. The same man-hours we formerly put into finishing now are used to prepare raw materials for the welding department and handle all finishing.

An example of cost reductions on the individual parts is the hood (Fig. 2). The hood made by the former method cost $1.99. We now fabricate it from three pieces of 12-gauge mild steel, flame-cut and brake-formed, for 94.3 cents, a saving of 52½%. Weight is also cut in half, from 17 to 8.5 pounds.

One of the interesting changeovers to welded design is the corrugated roll and shaft (Fig. 3). Weight was reduced from 18.5 to 11 pounds. The corrugated roll is now made of twelve angles, ⅛" x 1" x ⅝". Six of them at a time are inserted in a special jig and tack-welded together to form a half cylinder. The end discs, stamped from 12-gauge sheets, are slipped over the shaft and held in position for welding in a cradle-type jig. Then, using another special jig, the two corrugated halves are tack-welded to the discs. Tack welds give sufficient strength.

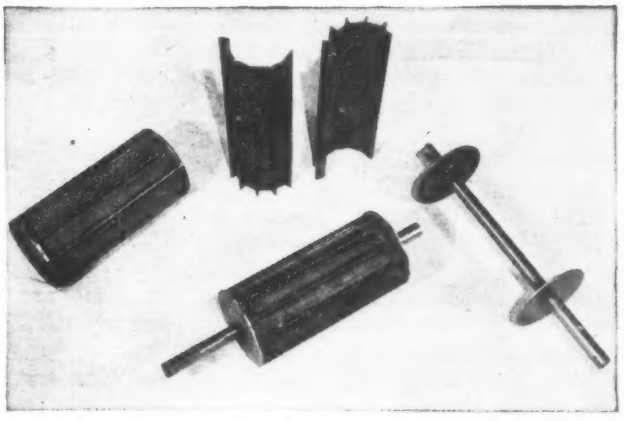


Fig. 3. At left is former corrugated roll. New welded roll and shaft (center) are fabricated from steel shapes as shown.

Welding the shaft and roll as an integral unit eliminates the man-hours formerly spent in machining and broaching keyways—a troublesome job.

In redesigning the flywheel (Fig. 4), weight was removed from the center, where it has a low moment of inertia, and concentrated on the rim, where it has the best effect. Thus the welded steel flywheel weighing 56 pounds has the same efficiency as the former design of 72 pounds.

The flywheel O.D. is 24". The rim is a 2" x 1¼" mild steel bar approximately 6' long which is heated, rolled and welded. Spokes are 3/16" x 2½" bars, drilled and broached at the center to match the hub of cold drawn tubing spaced between them. Welding is done in a jig which has a center post to hold the spokes and tubing in alignment, and three jaws which center the rim around the spokes. Each spoke is welded to the rim with a single pass, and two large tack welds join the hub to the spokes.

Other parts we have converted to welded design are the side plates, pulleys and smooth roll. The frame, formerly bolted, is now arc welded. All welding is done with "Fleetweld 7" electrode.

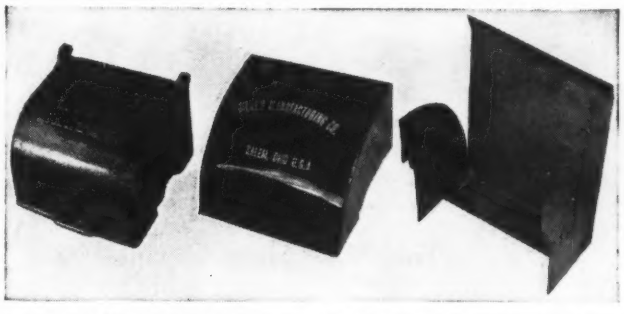


Fig. 2. Welded steel hood (center) costs 52% less than former design (left). How welded hood is made is shown at right.

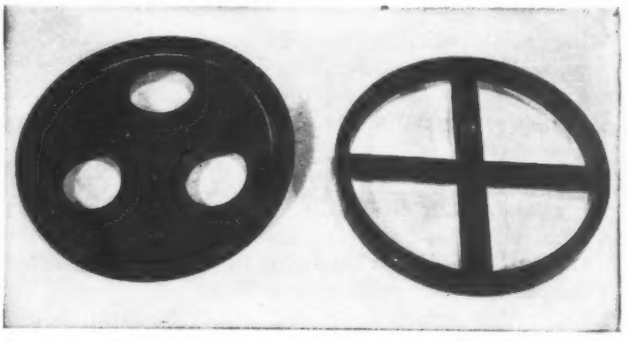


Fig. 4. The old flywheel was replaced by welded design (right) which weighs 23% less, but is just as efficient.

line of "Sealtight" resistance welding tips, designed for speedier welding, faster cooling, and longer life. 25

Slide-Rule for Corrosion Resistance Problems

H. M. HARPER Co., 2620 Fletcher St., Chicago 18, Ill. Pocket slide-rule showing the corrosion resistance of thirteen nonferrous and stainless-steel alloys in 142 corrosive applications.....26

Contour Grinding

PORTER-CABLE MACHINE Co., 1714 N. Salina St., Syracuse 8, N. Y. Bulletin describing a new method of contour grinding, performed by an abrasive-belt machine equipped with a specially shaped contact roll. 27

Flexible High-Frequency Conductors

TITEFLEX, INC., 519 Frelinghuysen Ave., Newark 5, N. J. Bulletin descriptive of the Titeflex high-frequency conductor, a water-cooled flexible lead designed to reduce power loss. 28

Motor-Driven Metallizing Gun

METALLIZING CO. OF AMERICA, 1330 W. Congress St., Chicago 7, Ill. Bulletin illustrating and describing the "Mogulectric" metal spray gun, driven by an electric motor, for production-line spraying. 29

Double-Acting Hydraulic Cylinders

HANNIFIN CORPORATION, 1101 S. Kilbourn Ave., Chicago 24, Ill. Bulletin 110, containing 52 pages of data on Hannifin double-acting hydraulic cylinders. 30

Collet Chuck

MERRION TOOL ENGINEERING Co., Berwyn, Ill. Leaflet illustrating and describing the Merrion collet chuck, an angle type fixture for second operations on round, square, or hexagon parts. 31

Air-Operated Devices

MEAD SPECIALTIES Co., Department FRB-26, 4114 N. Knox Ave., Chicago 41, Ill. Catalogue illustrating and describing the Mead line of air-operated devices. 32

Grinding and Sanding Wheels

BAY STATE ABRASIVE PRODUCTS Co., Westboro, Mass. Folder descriptive of the Bayflex raised-hub disk wheels applicable to all types of portable grinders and sanders for snagging, finishing, and cutting-off operations. 33

Force-Feed Lubricators

MANZEL BROTHERS Co., Buffalo, N. Y. Catalogue 94-B, illustrating and describing the operation and construction of Manzel force-feed lubricators of the liquid sight-feed type. 34

Steel-Platform Trucks

STANDARD PRESSED STEEL Co., Jenkintown, Pa. Circular containing data on the Hallowell line of steel-platform trucks, including dimensions, load ratings, weights, and price list. 35

Fan-Cooled Speed Reducers

MICHIGAN TOOL Co., 7171 E. McNichols Road, Detroit 12, Mich. Data Sheet 8974, describing the operation of the company's new cone-drive fan-cooled speed reducers.....36

Meehanite Castings

MEEHANITE METAL CORPORATION, Pershing Square Bldg., New Rochelle, N. Y. Bulletin 25, describing recent developments in the engineering applications of Meehanite castings. 37

Tool-Grinding Machines

OLIVER ISTRUMENT Co., Adrian, Mich. Catalogue descriptive of two new precision grinders for single-point sharpening of high-speed steel, Stellite, and tungsten-carbide tools. 38

Boring Tools

KAUKAUNA MACHINE CORPORATION, Kaukauna, Wis. Bulletin 117A-947S, descriptive of a general-purpose line of boring tools known as the "Kwik Size." Performance data is included.....39

Drill Jig Unit

INDUSTRIAL ENGINEERING Co., 730 E. Sample St., South Bend 18, Ind. Circular illustrating and describing the "Flip-Quick" drill chuck unit with spring-loaded locking device. 40

Axial Air-Gap Motors

FAIRBANKS, MORSE & Co., 600 S. Michigan Ave., Chicago 5, Ill. Bulletin 2760, describing the design and characteristics of the new Fairbanks-Morse axial air-gap motor. 41

Hard-Facing Process

METALLIZING ENGINEERING Co., INC., 38-14 Thirtieth St., Long Island City 1, N. Y. Bulletin 53, announcing a new hard-facing method known as the "Metco Sprayweld" process. 42

Lubrication Systems

BIJUR LUBRICATING CORPORATION, Long Island City 1, N. Y. Bulletin NB-2, describing specific applications of the Bijur system of automatic metered lubrication on machine tools. 43

Taps and Dies

CHARLES L. JARVIS Co., Middletown, Conn. Catalogue JDT-1, entitled "Tops in Tapping," covering the Jarvis-Dowding line of taps and dies; complete specifications are included. 44

Magnetic Chucks

HANCHETT MFG. Co., Big Rapids, Mich. Bulletin 047-1, describing Hanchett "Hermeti-Coil" magnetic chucks and accessories.....45

Vibration Mounts

HAMILTON KENT MFG. Co., Kent, Ohio. Bulletin illustrating and describing Rexon vibration mounts, available in sizes for loads of 1/2 pound to 3800 pounds.....46

Vibration Control Unit

KORFUND Co., INC., 48-71 Thirty-second Place, Long Island City 1, N. Y. Bulletin RS, descriptive of a new low-cost vibration control unit, of conical spring design.....47

V-Belt Sheaves

AMERICAN GEAR & MFG. Co., 5900 Ogden Ave., Chicago 50, Ill. Bulletin 305, containing size and price data covering White-Line standard V-belt sheaves. 48

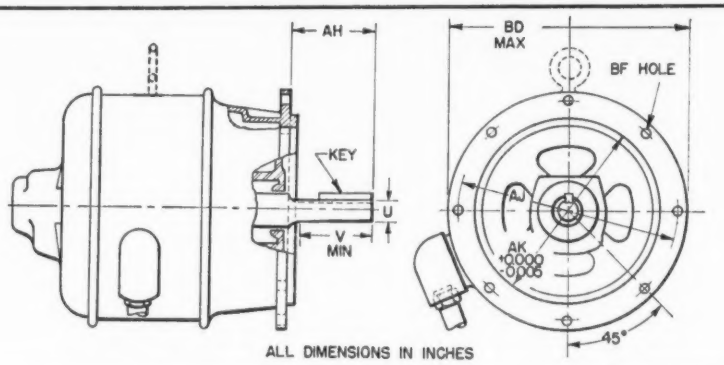
Motor Application Chart

HOWELL ELECTRIC MOTORS Co., Howell, Mich. Bulletin AC-80, containing a motor application chart showing the correct types of motors for various applications.....49

Tool-Steel Sheaves and Pins

TOOL STEEL GEAR & PINION Co., Cincinnati 16, Ohio. Bulletin entitled, "Hoist Your Profits with 'Tool Steel' Process Sheaves and Pins." 50

STANDARD DIMENSIONS OF FLANGE-MOUNTED TYPE D D.C. AND A.C. MOTORS (WITHOUT FEET)—1



ALL DIMENSIONS IN INCHES

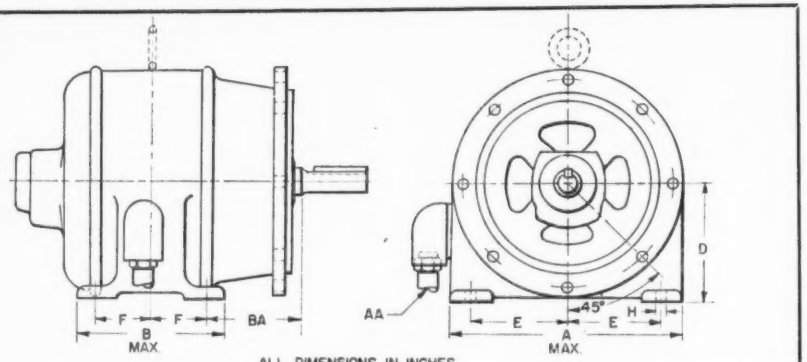
Frame Number	AK	AJ	BD Max.	AH	U	V Min.	Key		Clearance Holes BF	
							Width	Thick-ness	Size	Number
203D	9	10	11	2 1/4	3/4	2	3/16	3/16	17/32	4
204D	9	10	11	2 1/4	3/4	2	3/16	3/16	17/32	4
224D	9	10	11	3	1	2 3/4	1/4	1/4	17/32	4
225D	9	10	11	3	1	2 3/4	1/4	1/4	17/32	4
254D	9	10	11	3 3/8	1 1/8	3 1/8	1/4	1/4	17/32	4
284D	11	12 1/2	14	3 3/4	1 1/4	3 1/2	1/4	1/4	13/16	4
324D	11	12 1/2	14	4 7/8	1 5/8	4 5/8	3/8	3/8	13/16	4
326D	11	12 1/2	14	4 7/8	1 5/8	4 5/8	3/8	3/8	13/16	4
364D	14	16	18	5 5/8	1 7/8	5 3/8	1/2	1/2	13/16	4
365D	14	16	18	5 5/8	1 7/8	5 3/8	1/2	1/2	13/16	4
404D	14	16	18	6 3/8	2 1/8	6 1/8	1/2	1/2	13/16	4
405D	14	16	18	6 3/8	2 1/8	6 1/8	1/2	1/2	13/16	4
444D	18	20	22	7 1/8	2 3/8	6 7/8	5/8	5/8	13/16	8
445D	18	20	22	7 1/8	2 3/8	6 7/8	5/8	5/8	13/16	8
504D	18	22	25	8 5/8	2 7/8	8 3/8	3/4	3/4	13/16	8
505D	18	22	25	8 5/8	2 7/8	8 3/8	3/4	3/4	13/16	8
364SD	14	16	18	3 1/4	1 5/8	3	3/8	3/8	13/16	4
365SD	14	16	18	3 1/4	1 5/8	3	3/8	3/8	13/16	4
404SD	14	16	18	3 3/4	1 7/8	3 1/2	1/2	1/2	13/16	4
405SD	14	16	18	3 3/4	1 7/8	3 1/2	1/2	1/2	13/16	4
444SD	18	20	22	4 1/4	2 1/8	4	1/2	1/2	13/16	8
445SD	18	20	22	4 1/4	2 1/8	4	1/2	1/2	13/16	8
504SD	18	22	25	4 1/4	2 1/8	4	1/2	1/2	13/16	8
505SD	18	22	25	4 1/4	2 1/8	4	1/2	1/2	13/16	8

Note: When four holes *BF* are used, they are located at 45 degrees from the horizontal and vertical center lines.

These dimensions may also be applied to vertical motors, in which case the frame designations have the suffix letters DV or SDV.

MACHINERY'S Data Sheet No. 599, December, 1947 Compiled by the National Electrical Manufacturers' Association

STANDARD DIMENSIONS OF FLANGE-MOUNTED TYPE D D.C. AND A.C. MOTORS (WITH FEET)—2



ALL DIMENSIONS IN INCHES

Frame Number	Size of Conduit AA Minimum	A Max.	B Max.	D*	E	F	BA	H
203D	3/4	10	7 1/2	5	4	2 3/4	3 1/8	13/32
204D	3/4	10	8 1/2	5	4	3 1/4	3 1/8	13/32
224D	3/4	11	8 3/4	5 1/2	4 1/2	3 3/8	3 1/2	13/32
225D	3/4	11	9 1/2	5 1/2	4 1/2	3 3/4	3 1/2	13/32
254D	1	12 1/2	10 3/4	6 1/4	5	4 1/8	4 1/4	17/32
284D	1	14	12 1/2	7	5 1/2	4 3/4	4 3/4	17/32
324D	1 1/4	16	14	8	6 1/4	5 1/4	5 1/4	21/32
326D	1 1/4	16	15 1/2	8	6 1/4	6	5 1/4	21/32
364D	1 1/2	18	15 1/4	9	7	5 5/8	5 7/8	21/32
365D	1 1/2	18	16 1/4	9	7	6 1/8	5 7/8	21/32
404D	2	20	16 1/4	10	8	6 1/8	6 5/8	13/16
405D	2	20	17 3/4	10	8	6 7/8	6 5/8	13/16
444D	2	22	18 1/2	11	9	7 1/4	7 1/2	13/16
445D	2	22	20 1/2	11	9	8 1/4	7 1/2	13/16
504D	2 1/2	25	21	12 1/2	10	8	8 1/2	15/16
505D	2 1/2	25	23	12 1/2	10	9	8 1/2	15/16
364SD	1 1/2	18	15 1/4	9	7	5 5/8	5 7/8	21/32
365SD	1 1/2	18	16 1/4	9	7	6 1/8	5 7/8	21/32
404SD	2	20	16 1/4	10	8	6 1/8	6 5/8	13/16
405SD	2	20	17 3/4	10	8	6 7/8	6 5/8	13/16
444SD	2	22	18 1/2	11	9	7 1/4	7 1/2	13/16
445SD	2	22	20 1/2	11	9	8 1/4	7 1/2	13/16
504SD	2 1/2	25	21	12 1/2	10	8	8 1/2	15/16
505SD	2 1/2	25	23	12 1/2	10	9	8 1/2	15/16

Note: Flange and shaft dimensions given in Data Sheet 599.

*Dimension *D* will never be greater than the values given, but it may be less, so that shims are usually required for coupled or geared machines. When exact dimension is required, shims up to 1/32 inch may be necessary on frame sizes whose dimension *D* is 8 inches and less; on larger frames, shims up to 1/16 inch may be required.

MACHINERY'S Data Sheet No. 600, December, 1947 Compiled by the National Electrical Manufacturers' Association

BETWEEN GRINDS

On the Lighter Side

Welcome! The editors plan to open monthly peepholes on the page you are now scanning so that our readers may participate in the behind-the-scene activities of MACHINERY. Here you may expect a medley of letters of praise, censure, query, or information; items of human interest; bright and not-so-bright comments on events in our industry; facts about articles we are publishing or contemplate publishing; and who knows, perhaps even an occasional joke. And so we introduce to you "Between Grinds."

Flying Books

A Turkish customer was so anxious to receive two of our books ("Engineering Encyclopedia" and "Ingenious Mechanisms") with minimum delay that he asked us to forward them by air mail. For this quick delivery service, said customer is paying $30 in postage. While the books may be worth their "weight in gold," in this case they actually sold for less than their "weight in postage."

Sleighbells and Stuff

One of our editors recently found himself in an assignment which, when boiled down, amounted to "all play and no work," thus reversing the usual routine. We refer to the feature article "Making the 'Christmas Tree' Express" which covers the manufacture of miniature electric trains at the Lionel Corporation. It was with difficulty that he was held down to technical writing as, waxing eloquent, such phrases crept in as "in the pleasant surrounding of puffing and whistling scale model electric trains" and "the caboose which trails the freight through the 'winter wonderland.'" He finally settled down, however, to a factual presentation of details, which you may read in this issue.

The Editor and the Crystal Ball

Way back in April, an editorial in MACHINERY stressed the importance of training skilled workmen of the future through the apprenticeship system. Recently among releases received from the Department of Labor were a speech delivered by William F. Patterson, Director of Apprentice-Training Service, on November 4 and an article "Training Tool and Die Workers," which elaborated on the substance of our editorial. "Handle that crystal ball carefully, porter!"

Tumbling Along

Tumbling, an old finishing process when grandfather was a boy, is brought up to date in the leading article in this issue, "Abrasive Tumbling Reduces Finishing Costs." Rumor has it that this barrel rolling process is simply a reversal of an old national pastime, namely rolling out the barrel, but probably the fact that it reduces finishing costs and improves part quality more accurately accounts for its popularity. On the tumbling team are the Wright Aeronautical Corporation, P. & F. Corbin Co., and International Business Machines, whose activities are described by way of case history stories in the article.

You're Welcome, Chum

A letter from a New Orleans correspondent asking for information regarding the graduating machines referred to in MACHINERY'S HANDBOOK ended in a spirit of camaraderie with "Thanks, Pal."

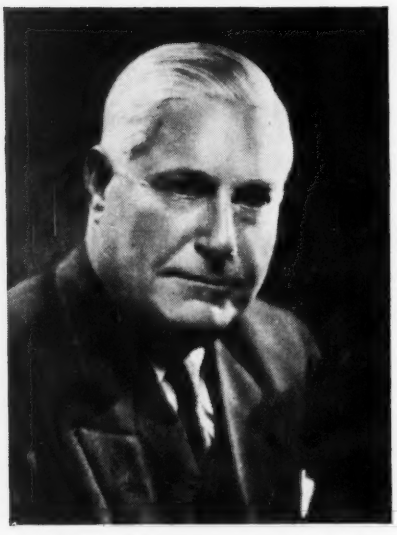
No Box Tops Required

Snowed under by requests for reprints of the article "What is the Big Job Now for Machine Tool Builders?" authored by Bernard Lester and presented in October MACHINERY, we had a big batch run off by our printing department. After distributing thousands to companies who felt this article to be of moment to their personnel, we still have a limited number of copies of this popular article available, which you may have gratis on the principle "first come, first served." Just drop us a line.

Santa Speaks

We end this initial outburst with a Christmas wish from MACHINERY to all our readers for a very Merry Christmas full of holiday spirit, fun and a goodly haul of gifts—which reminds us—there could be no more satisfactory and impressive gift than a copy of our three-pound MACHINERY'S HANDBOOK, which really would weigh down any sock hanging from any mantelpiece. *Merry Christmas.*

News of the Industry



(Left) Delbert F. Axelson, Who is Retiring as Vice-president in Charge of Manufacturing of the Axelson Mfg. Co., after Forty Years' Service, and (Center) Victor Mancuso Who Succeeds Mr. Axelson. (Right) R. M. Pease, Recently Advanced to the Post of Vice-president and Assistant General Manager of the Company

California

DELBERT F. AXELSON, formerly vice-president in charge of manufacturing of the Axelson Mfg. Co., Los Angeles 11, Calif., has retired upon the completion of forty years of association with the company, which was founded in 1892 by his father and uncle. R. M. PEASE, previously vice-president and manager of the company's plant in St. Louis, Mo., has been made vice-president and assistant general manager, with headquarters at the main plant in Los Angeles. VICTOR MANCUSO, previously works manager, has been advanced to the position of vice-president in charge of manufacturing.

WARD LEONARD ELECTRIC CO., 31 South St., Mount Vernon, N. Y., manufacturer of electric controls, has appointed W. R. L'HOMMEDIEU, 722 E. Washington Blvd., Los Angeles 21, Calif., sales representative of the company in the Los Angeles area.

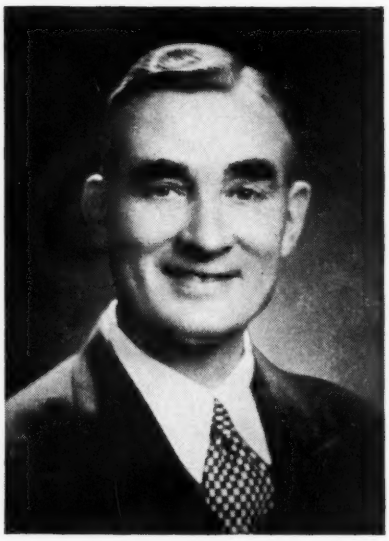
V. & E. MFG. CO. has recently completed a new office, engineering, and assembly building at 766 S. Fair Oaks Ave., Pasadena, Calif., which will provide enlarged facilities for the fabrication of Vemco drafting machines and drawing instruments.

PATSY QUALTIERI has been appointed district manager of the Los Angeles office of the Micromatic Hone Corporation, which is located at 1323 S. Santa Fe Ave.

Illinois, Missouri, and Indiana

CHARLES T. MARSH has been made sales representative in the territory of Illinois and Indiana for the Acro Welder Mfg. Co., 'Milwaukee, Wis. His headquarters will be at 4022 N. Francisco Ave., Chicago, Ill.

EARL R. NELSON has been appointed manager of the Cincinnati plant of Joseph T. Ryerson & Son, Inc., Chicago, Ill., succeeding WAYNE D. DUKETTE. Mr. Dukette will head the company's new steel-service plant now under construction in the San Francisco area.



Earl R. Nelson, Recently Appointed Manager of the Ryerson Cincinnati Plant

JOSEPH D. QUILL was appointed on November 1 MACHINERY'S subscription representative for Iowa, Minnesota, Missouri, Wisconsin, and southern Illinois. H. A. BRADLEY will concentrate his sales activities in northern Illinois, southwestern Michigan, and the northern and western sections of Indiana, with headquarters in Chicago.

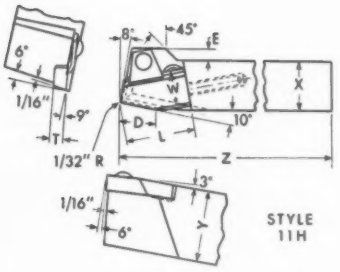
FOOTE BROS. GEAR & MACHINE CORPORATION, Chicago, Ill., announces the advancement of R. B. MOIR to the post of assistant vice-president in charge of engineering and product development of the Industrial Gear Division. B. H. QUACKENBUSH, formerly assistant sales manager, becomes sales manager of the division.

DUAL PRESS CO., St. Louis, Mo., manufacturer of brake presses for bending, forming, blanking, and multiple punching, announces the appointment of the MACHINERY & WELDER CORPORATION, of St. Louis, as national wholesale distributor for the sales and servicing of the company's line of presses. The new sales and service organization will be known as the DUAL BRAKE PRESS DIVISION OF MACHINERY & WELDER CORPORATION.

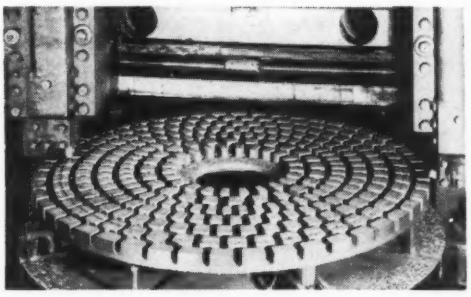
CINCINNATI MILLING MACHINE CO. and CINCINNATI GRINDERS, INC., an-

IF Interrupted Cuts Are Your Problem

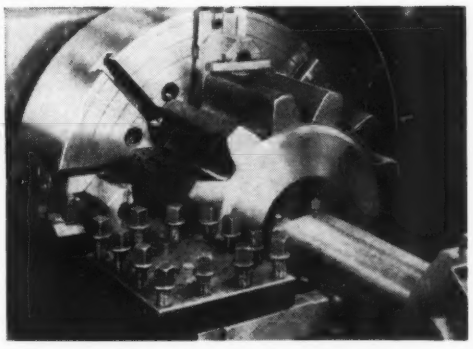
Learn About Kennametal



Style 11H is one of a complete line of Kennametal tools, having sturdy, clamped-in, advanceable Kennametal tips. This assembly—developed by Kennametal—is highly successful on interrupted cutting, and is equally outstanding on continuous-cut operations. It utilizes Kennametal's high strength to best advantage—provides a thermally-strain-free assembly; makes possible deep cuts and heavy feeds; simplifies grinding since tip is advanced and re-sharpened without removing any steel from shank; and enables practically all of the Kennametal tip to be utilized for cutting.



This iron casting has 288 chilled lump interruptions. A Kennametal standard Style 11T80 tool faces and turns it at 190 ft./min., .048" feed, and ¼" depth of cut.



Kennametal bores, turns, and faces over interruptions and sand holes on this chrome-nickel steel rack pinion. Speed—155 ft./min.; feed—.032"; depth of cut—¼" to 5/16". Performance is 5 to 1 over high speed steel tools in production and pieces per grind.

You're probably enjoying the advantages of carbide tooling on continuous-cut operations—but how about interrupted cutting?

Has this given you tool trouble, and made you resort to slower machining methods on some important jobs?

If so, Kennametal will help you solve this problem. Its ability to withstand the shock of interrupted cuts, on both cast iron and steel, has been unequalled.*

Although cutting conditions are often improved by changing the tool shape so that the shock will be imposed on a section of the tip that is stronger and better supported, it is still the carbide that must take the punishment. Here's where Kennametal has a distinct advantage.

Because of exclusive processing methods and careful control in manufacture Kennametal's impact strength is unusually high for such a hard material—as great as that of hardened alloy steels having much lower hardness and compressive strength.

Still further advantages for interrupted cutting are obtained by the use of mechanically-held tools developed by Kennametal Inc. Tips of characteristically high impact strength are securely clamped to, and firmly supported by a heat-treated steel shank, to provide an exceptionally strong strain-free assembly.

If you have had difficulty with carbide tools on interrupted cuts, let us engineer Kennametal to the solution of your particular problem.

**Ask us to send you a set of Performance Reports that demonstrate the superior results obtained with Kennametal Tools on interrupted cutting.*

KENNAMETAL Inc.

Trade Mark Reg. U. S. Pat. Off.

LATROBE, PA.

MANUFACTURERS OF SUPERIOR CEMENTED CARBIDES AND CUTTING TOOLS THAT INCREASE PRODUCTION

nounce the opening of a new direct field engineering office located in Room 218, Chamber of Commerce Bldg., 320 N. Meridian St., Indianapolis, Ind. This office will be under the supervision of HOWARD L. POPE, manager of the Cincinnati-Indiana territory, who will be assisted by ARTHUR MEALS and CHARLES WILLIAMS.

Michigan

NATIONAL TWIST DRILL & TOOL CO. recently held a two-day Open House at its new $7,000,000 plant in Rochester, Mich., which was attended by about 2000 guests. All activities of the company and the Winter Brothers Co. Division are now located in this plant.

HAROLD F. HOWARD, for many years connected with the Chevrolet Division of General Motors Corporation, has formed his own organization as management consultant, to be known as the HAROLD F. HOWARD CO., with offices in the Fisher Bldg., Detroit, Mich.

MICROMATIC HONE CORPORATION, manufacturer of honing machines and equipment, has recently completed a 38,000 square foot addition to its main plant at 8100 Schoolcraft, Detroit 4, Mich., where all operations of the company are now consolidated.

STEPHEN JOHNSON, JR., has been appointed chief engineer of the Bendix-Westinghouse Automotive Air Brake Co., 1104 Fisher Bldg., Detroit 2, Mich.

C. H. WILLS has been named general sales manager of the Michigan Abrasive Co., Detroit, Mich.

New England

P. R. HATCH has been made sales director of the Brown & Sharpe Mfg. Co., Providence, R. I., succeeding the late C. W. Machon. Mr. Hatch will have associated with him H. L. MERRILL, W. H. SPENCE, and W. E. ANDERSON.

BOSTON GEAR WORKS, INC., North Quincy, Mass., has been purchased by the MURRAY CO., and will be operated henceforth as the BOSTON GEAR WORKS DIVISION OF THE MURRAY CO. Operations will continue at the North Quincy plant.

CLYDE A. SLUHAN, for several years Connecticut salesman with the Anderson Oil Co., Portland, Conn., maker of rust preventives and cutting fluids, has been appointed manager of industrial sales.

New York and New Jersey

HAROLD H. REED, formerly assistant manager of the metropolitan New York district for the Air Reduction Sales Co., New York 17, N. Y., has been appointed manager of that district, succeeding W. S. SCHOENTHALER, who is retiring after thirty-seven years of service with the company. OREN M. DONOHUE, assistant sales manager, will succeed Mr. Reed as assistant manager of the metropolitan district, and WILLIAM B. BROWER will take Mr. Donohue's place as assistant sales manager.

LEAD-ALL PRODUCTS CO., 24 E. 21st St., New York 10, N. Y., manufacturer of screwdrivers, flexible extension shafts, and wire strippers, announces that the name of the company has been changed to RUMAC MFG. CO. in order to avoid confusion with another concern of a similar name. The company also announces the removal of its Chicago office to 615 N. Michigan Ave., Chicago 11, Ill.

ALBERT S. ROETHELI CO., 24-16 Bridge Plaza South, Long Island City 1, N. Y., has been appointed representative in New York City and vicinity for several divisions of the AMERICAN GAGE & MACHINE CO., including the Size Control Co. Division and the Walsh Press & Die Co. Division.

E. W. DECK, formerly general manager of the Trent Tube Mfg. Co. at East Troy, Wis., has been made manager of the Ithaca, N. Y., plant of the Morse Chain Co., a division of the Borg-Warner Corporation, Chicago, Ill.

CHROMIUM CORPORATION OF AMERICA, 120 Broadway, New York 5, N. Y., announces the election of the following officers: FRANK J. O'BRIEN, president, and DONALD H. BISSELL, vice-president, secretary, and director.

CHARLES D. W. GIBSON and JOHN A. HILL, vice-presidents of Air Reduction Co., Inc., 60 E. 42nd St., New York 17, N. Y., have been elected directors of the company.

ROBERT C. GRAVES has been appointed vice-president in charge of sales of the Federal Electric Products Co., Newark, N. J. Mr. Graves has had more than twenty-eight years of experience in the electrical manufacturing industry. He was formerly vice-president in charge of sales of the Trumbull Electric Mfg. Co.

JOHN A. DEITRICH has been appointed manager of the Alloy Tube Division, Carpenter Steel Co., Union, N. J., succeeding E. W. BACHMAN, who will continue to serve in an advisory capacity.

Ohio

WALTER G. TUCKER has been elected chairman of the board of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, following the resignation of COLONEL H. A. TOULMIN, JR., as board chairman, president, and general manager. Dr. Tucker is resuming the responsibilities that he carried from 1933 to 1945, following seventeen years of service as president of the company. PAUL C. POCOCK, formerly vice-president in charge of sales, will assume active direction of the company's operations as executive vice-president and general manager. WARREN R. TUCKER was elected to the newly created post of vice-president in charge of engineering and research.

TIMKEN ROLLER BEARING CO., Canton, Ohio, is engaged in constructing a $150,000 rock bit plant at Colorado Springs, Colo., which is expected to be in operation shortly. FRANK M. GIVIN, general foreman of the company's Mount Vernon plant, has been named manager of the new unit. The company has also recently announced the transfer of WILLIAM E. BRYDEN, sales engineer from the Chicago office, to the Cincinnati office of the Timken Steel and Tube Division. He will be succeeded at Chicago by WILLIAM T. STRICKLAND.

FRANK R. KOHNSTAMM, for twenty-five years associated with the Westinghouse Electric Corporation in Cleveland and Mansfield, Ohio, has joined the staff of Jack & Heintz Precision Industries, Inc., Cleveland, Ohio, as general sales manager. Prior to his present appointment he was manager of the Testing Equipment Division of the Baldwin Locomotive Works.

B. D. CLAFFEY has been elected executive vice-president of Acme Aluminum Alloys, Inc., Dayton, Ohio. Mr. Claffey organized the Claffey Castings Co., Waukesha, Wis., which was purchased by the General Malleable Corporation in 1936, at which time he became manager of the aluminum and gray iron divisions of that corporation.

BYRON C. FOY was recently elected president of Jack & Heintz Precision Industries, Inc., Cleveland 1, Ohio, succeeding WILLIAM S. JACK. Mr. Foy is also chairman of the board. ALBERT A. RICKER, vice-president in charge of finance, has been appointed to the newly created position of assistant to the president.

RICHARD SCOTT HUXTABLE has been appointed executive vice-president and general manager of the Fawick Airflex Co., Inc., Cleveland, Ohio.

PEOPLE DON'T STANDARDIZE ON "SUBSTITUTES"

For nearly 15 years, molybdenum high speed steels have *proved on their own merits* that they are *superior* steels. Long before World War II, during the war, and up to the present moment, these steels have done *more* work for *less* money.

Molybdenum high speed tool steels, for instance, are not only tougher, and do more work per job, but are consistently cheaper than 18-4-1. In addition, they are from 6% to 9% less dense, so more tools may be made from the same gross weight of steel.*

Get the facts about what molybdenum high speed steels can do for you.

**FREE BOOKLET on molybdenum high speed steels gives proof of these statements. Write for it.*

MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"
CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

Climax Molybdenum Company
500 Fifth Avenue · New York City

MOLY

Prior to his present appointment, he was assistant to the vice-president and general manager of the Cleveland Diesel Engine Division, General Motors Corporation.

JERRY SINGLETON has been appointed assistant to Tom J. Smith, Jr., president of the Pressed Metal Institute, Cleveland 14, Ohio. Mr. Singleton has had more than twenty years of experience in contact work with trade associations.

FRANK R. O'DONNELL has been named general manager of the CHAMPION FORGE CO., which recently acquired the assets of the CHAMPION MACHINE & FORGING CO., 3695 E. 78th St., Cleveland, Ohio. LESTER L. REUSE will have charge of sales.

Pennsylvania and Maryland

Kennametal Inc., Latrobe, Pa., manufacturer of cemented-carbide cutting tools, announces the following appointments: JEROME G. BRADY, tool engineer and representative at the Pittsburgh district office; LESTER SPEICKHOFF, tool engineer and representative in the Syracuse area. The company has also recently announced the appointment of K. W. JONVIK, Dronningens gt 17, Oslo, Norway, as foreign representative.

HAROLD O. HILL, assistant chief engineer for fabricated sheet construction of the Bethlehem Steel Co., Bethlehem, Pa., was elected president of the American Welding Society for the year 1947-48, at the recent annual meeting of the society in Chicago. Mr. Hill has held many offices in the sixteen years during which he has been a member of the Society.

Harold O. Hill, Recently Elected President of the American Welding Society

JULIUS HEUSCHKEL, welding specialist at the Westinghouse Research Laboratories, Pittsburgh, Pa., has won the $750 first prize in the annual contest of the Resistance Welder Manufacturers' Association for the second year in succession. The 1947 award was presented to Mr. Heuschkel for his paper on the metallurgical aspects of carbon-steel spot-welding, which was read before the annual meeting of the American Welding Society in October.

GEORGE W. FRICK has been named special representative in sales development for the Latrobe Electric Steel Co., Latrobe, Pa. Mr. Frick was affiliated for many years with the Firth-Sterling Steel & Carbide Corporation, and more recently founded the Carbide Die Mold Co.

DAVID G. HENDERSON, P. O. Box 8002, Pittsburgh, Pa., has been appointed sales engineer for the line of hydraulic and pneumatic cylinders, presses, riveters, power units, and control valves made by the Hannifin Corporation, 1101 S. Kilbourn Ave., Chicago, Ill.

J. R. DOUGHTY has been appointed manager of the export sales department of SKF Industries, Inc., Philadelphia, Pa. In addition to filling his new duties, he will continue to serve as manager of the sales contract department.

JESS W. SPIKER recently became associated with the Penn Carbide & Alloy Casting Co., Greenock Road, Elizabeth 1, Pa., in the capacity of sales manager. He was formerly with the Carbide Die & Mold Co., of Pittsburgh, Pa.

LEEDS & NORTHRUP CO., Philadelphia, Pa., has purchased a building one block from its main plant which will add approximately 11,000 square feet of floor space to the plant.

W. R. MAU, western sales manager of the Vanadium-Alloys Steel Co., Latrobe, Pa., and LYNN A. SMITH, have been elected members of the board of directors of the company.

DYKMAN MFG. CO., a newly organized firm, of which R. W. DYKMAN is owner, has purchased the equipment of the BARCUS ENGINEERING CO., INC., at 3931 Falls Road, Baltimore 11, Md., where the company will manufacture a patented shaft coupling of the flexible gear type. Mr. Dykman was for some years manager of the firm he has recently acquired by purchase, and plans a more active conduct of its business. The new concern will produce a coupling for industrial use under the trade name "Sphere-Gear," and a marine type coupling under the same name.

Coming Events

DECEMBER 1-5—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Atlantic City, N. J.; headquarters, Chalfonte-Haddon Hall. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.

DECEMBER 1-6—Twenty-first CHEMICAL INDUSTRIES EXPOSITION at the Grand Central Palace in New York City. For further information, address International Exposition Co., Grand Central Palace, New York 17.

DECEMBER 4-6—Annual meeting of the SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS at the Hotel Pennsylvania, New York City. Further information can be obtained from the Society, P.O. Box 168, Cambridge 39, Mass.

JANUARY 12-16—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

JANUARY 12-16—Second NATIONAL MATERIALS HANDLING EXHIBITION in the Public Auditorium, Cleveland, Ohio. Those interested can obtain further information from Clapp & Poliak, Inc., 350 Fifth Ave., New York 1, N. Y.

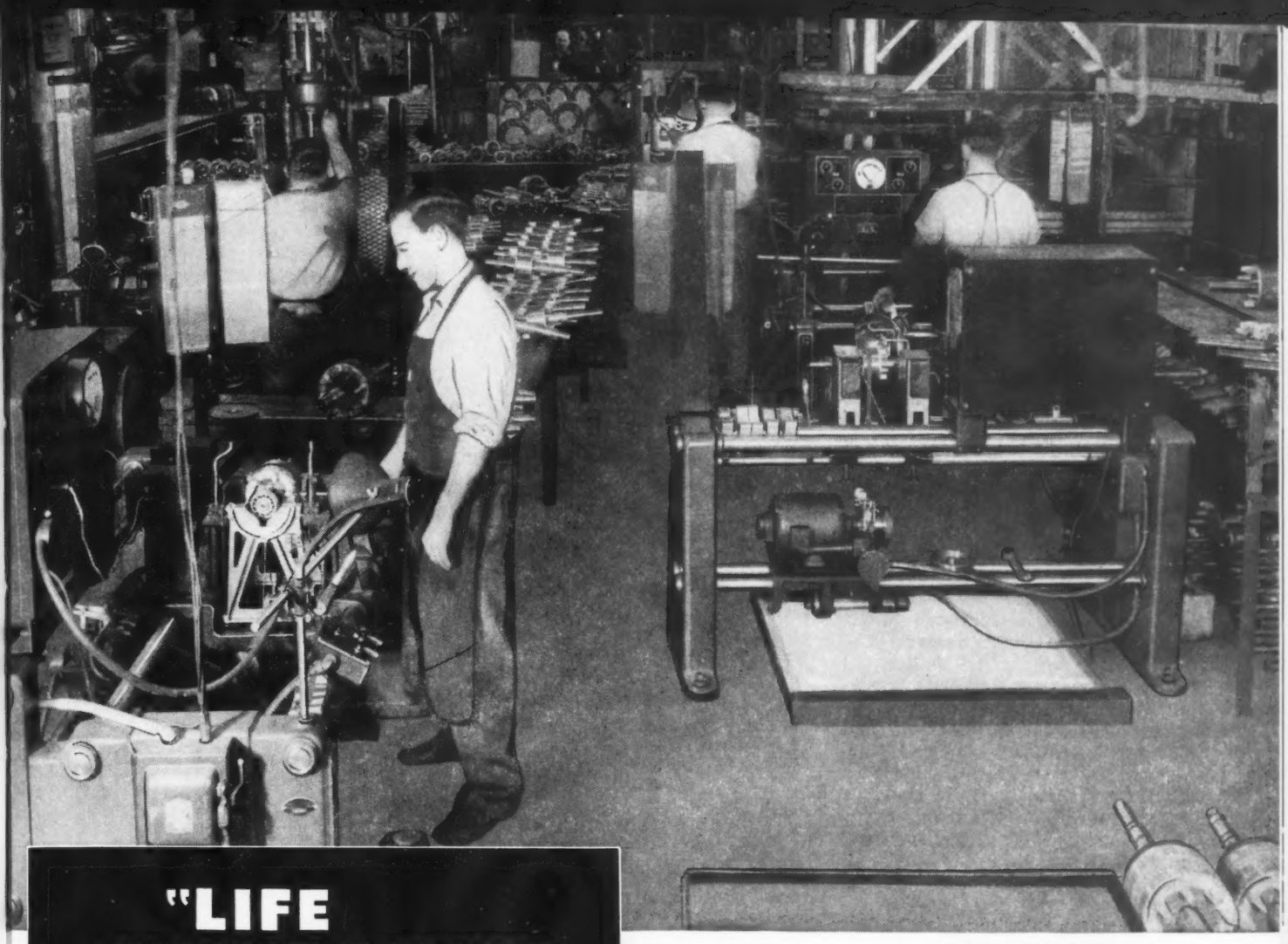
MARCH 15-21 — Sixteenth annual meeting and Tool Exhibition of the AMERICAN SOCIETY OF TOOL ENGINEERS in Cleveland, Ohio. Harry E. Conrad, executive secretary, 1666 Penobscot Bldg., Detroit 26, Mich.

MARCH 18-19—Fourth annual meeting and exhibit of MAGNESIUM ASSOCIATION at the Pennsylvania Hotel, New York City. Further information can be obtained from the Association, 30 Rockefeller Plaza, New York 20, N. Y.

MARCH 22-24—CHICAGO PRODUCTION SHOW and TECHNICAL CONFERENCE at the Stevens Hotel, Chicago, Ill., under the sponsorship of Chicago Technical Societies Council, 53 West Jackson Boulevard, Chicago 4, Ill.

JANUARY 13-14—Special national session of the Materials Handling and Management Divisions of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Cleveland, Ohio, with headquarters at the Hotel Statler.

FEBRUARY 10-11—Annual meeting of the PRESSED METAL INSTITUTE at the Hotel Statler in Buffalo, N. Y. For further information, address the Institute, Union Commerce Bldg., Cleveland 14, Ohio.



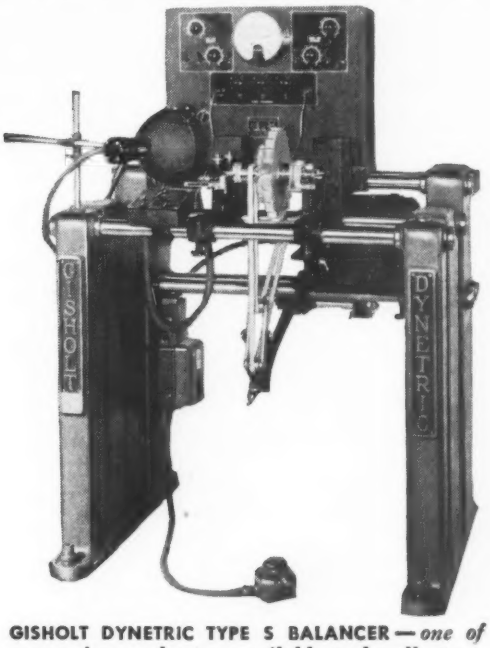
"LIFE INSURANCE"

for electric motors

Gisholt DYNETRIC* Balancing Machines† increase the life expectancy of electric motors by eliminating the most common cause of failure—*vibration.*

But they do more than that—they insure smoother, more efficient performance. No matter what the job may be, they do a better job. That's important—not only from the user's standpoint but from the manufacturer's as well.

Balancing Departments, like that pictured above, handle this work quickly and economically when they are equipped with Gisholt DYNETRIC Balancing Machines. They put balancing on a mass production basis. And they provide a degree of accuracy which cannot be equaled by any other means.



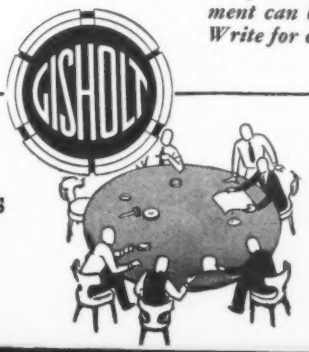
GISHOLT DYNETRIC TYPE S BALANCER—*one of many sizes and types available to handle parts from a fraction of an ounce up to many tons. Locating and measuring unbalance requires but a matter of seconds. Where practical, correction equipment can be included as a part of the machine. Write for complete details.*

GISHOLT MACHINE COMPANY
Madison 3, Wisconsin

**DYNETRIC is a Trade-mark Reg. U. S. Pat. Off. by Westinghouse Electric Corporation.*

†Developed jointly with Westinghouse Electric Corporation.

TURRET LATHES • AUTOMATIC LATHES
SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface-finishing, and balancing of round and partly-round parts. Your problems are welcomed here.*

New Books and Publications

INDUSTRIAL MANAGEMENT. By William R. Spriegel. 656 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $5.

This comprehensive text-book covering all phases of industrial management is now in its fourth edition. The new edition has been completely revised to include the most recent developments in the field. Besides a new chapter on maintenance, over 100 illustrations have been added.

The theory presented is based on actual successful practice, and specific methods and systems are described. The subject is discussed under the following main headings: Fundamental Considerations in Industry; Organization Structure; The Plant and Equipment; Motion and Time Study; Wage Payment; Buying Selling, and Transportation; Material and Production Control; and Personnel Administration and Management. A statement of the author in the preface as a basic principle underlying successful management is worth noting: "Scientific management strives to harmonize the various interests involved in the productive process. Business relationships have been treated with the belief that faith must be created in modern business—faith of the management in the employe, and faith of the employe in the management."

ENGINEERING ORGANIZATION AND METHODS. By James E. Thompson. 337 pages 6 by 9 inches. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y. Price, $4.

Tested techniques for speeding up production and reducing costs in product design engineering departments are described in this book. It outlines a fundamental plan for organizing, operating, and controlling these departments, and describes methods that have been used successfully in both large and small engineering departments of a wide variety of technical concerns. The book supplies the data necessary for the preparation, processing, recording and release of engineering information, and includes a general discussion of the functions of supporting departments. All forms required for detail methods are described, together with examples of the use of each.

ELECTRIC MOTOR MAINTENANCE. By W. W. McCullough. 126 pages, 5 1/2 by 8 1/2 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $2.

Maintenance men, inspectors, supervisors, and students will find detailed information in this manual on the maintenance and repair of electric motors. Specific instructions are given for inspecting each type of motor with a view to preventing breakdowns. The author, who is with the manufacturing and repair division of the Westinghouse Electric Co., is a service engineer of long experience.

The book is divided into three sections: The first, dealing with mechanical maintenance, covers motor assembly, bearings, current collecting devices, and air gaps. The second part, on electrical maintenance, treats of insulating materials, cleaning, drying, and testing. The third section, on operation and application, discusses characteristics of induction; direct-current, synchronous, and gear motors; motor-generator sets; and electric couplings.

MATERIALS HANDBOOK. By George S. Brady. 831 pages, 5 1/2 by 8 1/2 inches. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y. Price, $7.

Basic data on all kinds of industrial materials is presented in this handbook, the sixth edition of which has just been published. The data has been selected to meet the primary requirements of industrial executives, designers, architects, purchasing agents, and builders of mechanical equipment. The book does not attempt to provide an exhaustive treatise on any material, but rather presents general information on properties and applications, together with such figures as will enable the user to form a quick judgment of the comparative characteristics of materials and their suitability for various purposes.

ORGANIZATION AND MANAGEMENT IN INDUSTRY AND BUSINESS. By William B. Cornell. 819 pages, 6 by 9 inches. Published by the Ronald Press Co., 15 E. 26th St., New York 10, N. Y. Price, $5.

This is the third edition of a comprehensive treatise on organization and management. The material has been revised to include the most up-to-date practice. The book is divided into three parts: Part 1 analyzes the industrial problem, and shows the way an entire program is worked out, beginning with a study of products and possible markets and ending with the requirements to be met in financing a business; Part 2 deals with production control and time study; and Part 3 gives details of the systems employed by four representative manufacturing plants.

CONTROL CHARTS. By Edward S. Smith. 161 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $3.

Designed for the busy executive in industry, this book provides a simplified, non-mathematical introduction to charts of statistical quality control, covering their construction, interpretation, and application. It shows clearly how control charts can aid in obtaining quality in manufactured products. Frequency distribution curves and their use in analyzing statistical data are discussed, and a new method of determining the satisfactory location of control limits with respect to specification limits is described.

GRINDING WHEELS, 61 pages, 6 by 9 inches. Published by the United States Department of Commerce as Simplified Practice Recommendation R45-47. Obtainable from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price, 15 cents.

* * *

Metal Gage Comparator

Twin "K" Products, 2322-46 Newport Ave., Dayton 5, Ohio, is distributing a chart giving the equivalents of metal gages in thousandths of an inch, fractions, millimeters, mils, and circular mils. The gages included are sheet lead, sheet zinc, sheet copper, Birmingham (Stub's), American (B&S), U. S. Standard (old and new), U. S. steel wire, piano wire, British Standard and Stub's steel wire. Measurements are shown up to 1/4 inch in increments of 0.001 inch. An index shows which gages are applicable to the various classes of sheets, wires, rods, and tubes. The chart is available in quantities, with imprint to manufacturers who wish to distribute it to their customers. Individuals can obtain copies directly from Twin "K" Products.

* * *

Production of a new aluminum roofing material for industrial use, known as "Alcoa" industrial roofing, is announced by the Aluminum Company of America, Pittsburgh 19, Pa. The new product is a light-weight, heavy-duty specially formed material, developed by the research department of the company to meet the demand of industrial builders for an aluminum roofing and siding specifically adapted to factories, warehouses, storage depots, hangars, and similar structures. It is stated that the new industrial roofing will carry heavy loads and meet the exacting requirements of building codes.

You Can TELL It's a Threadwell

— by its COLD-TEMPER performance — treated at 120° below zero to give it the hardness that means more threads per tap

— by its *i-dot-ification*—*red* dot for cut thread, *white* dot for commercial ground, *blue* dot for precision ground

— by its *polished flutes* for extra protection against chip clogging and breakage

— by its greaseless rust-proofing that keeps it clean, dry and shining—never messy and sticky

— by its *tap-capsule* that provides individual tap protection and makes it easy to select the right tap before unwrapping

— by the *personal attention* service your tap orders, large or small, get at the factory and at your local Threadwell distributor's.

See for yourself what these Threadwell extras mean to you in terms of better, easier, lower cost thread production. Just ask for Threadwell — they cost no more.

Delivery on standard items now being made from stock

SOLD EXCLUSIVELY BY MILL SUPPLY DISTRIBUTORS THROUGHOUT THE UNITED STATES AND THE WORLD

THREADWELL TAP AND DIE COMPANY · GREENFIELD, MASSACHUSETTS, U. S. A.

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Threadwell

"TAPS OF DISTINCTION"

Inspecting Castings by Three-Dimensional Optical Projection Method

A method of inspecting and laying out castings by three-dimensional projection of accurate lay-out drawings upon the rough castings has been developed by the engineers of the Pittsfield Works of the General Electric Co. This method has been successfully applied for several years, and has effected considerable savings in time and material.

The optical projection method, originally designed for inspecting and laying out parts for subsequent machining operations, has also been used for the rapid inspection of finished parts. It can be employed during an actual machining process, whether the part to be machined is stationary or revolving. The equipment assures holding a lay-out within accuracy limits of 0.015 inch.

The apparatus has a lay-out image projector, shown in the accompanying illustration at *E*, which contains a photographic glass slide showing the finished casting lay-out. The lay-out is projected by a lens directly upon the surface of the casting *C*. To establish the plane of true projection and correct dimensions, a second projector *A* projects an inspection plane or "light wand" over the work inspection position. This "light wand" emits a sheet of light which falls vertically upon the casting. Both projectors operate in unison through a selsyn system. Thus the "light wand" from projector *A* always designates the proper plane for the image imposed by the projector *E*, as well as its correct focus and size.

The inspection pedestal assists in positioning the rough casting by means of an electric drive. An adjustable surface plate *D* facilitates the final location of the casting coincidental to the sheet of light from the inspection plane projector *A*.

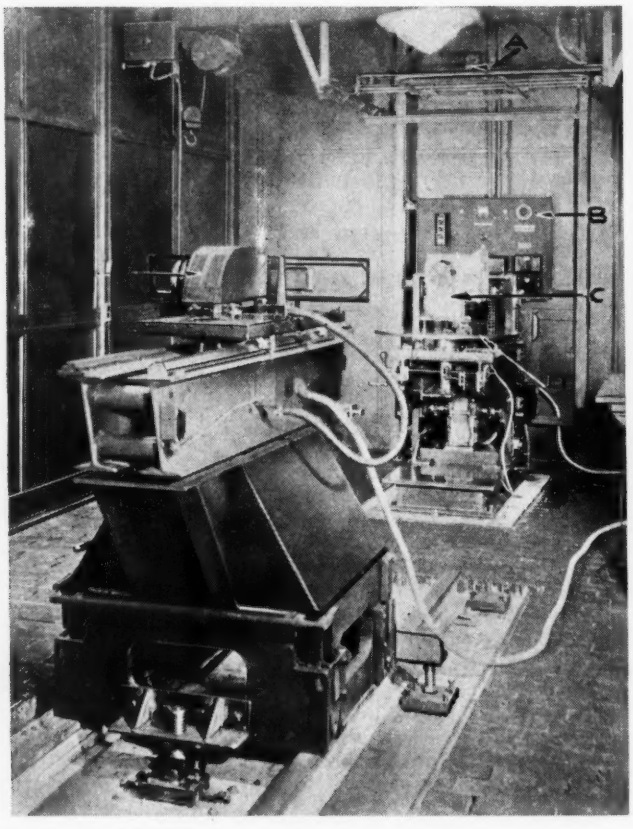
In machining a piece that revolves and is symmetrical about the axis of rotation, the finished outline can be readily projected to serve as a templet. This templet-projector system can be used in fabricating duplicate metal parts for tanks, boilers, and other flame-cut and welded pieces. Variations of this system can be used for laying out intricate pieces, locating parts to be welded. shearing, and general lay-out operations.

Practical application of this three-dimensional method requires drawings of the finished castings which are suitable for photographing. The size and focus of the drawing image on the ground glass of the camera are checked by a microscope for accuracy. The control panel for operating the three-dimensional projecting equipment is shown at *B*.

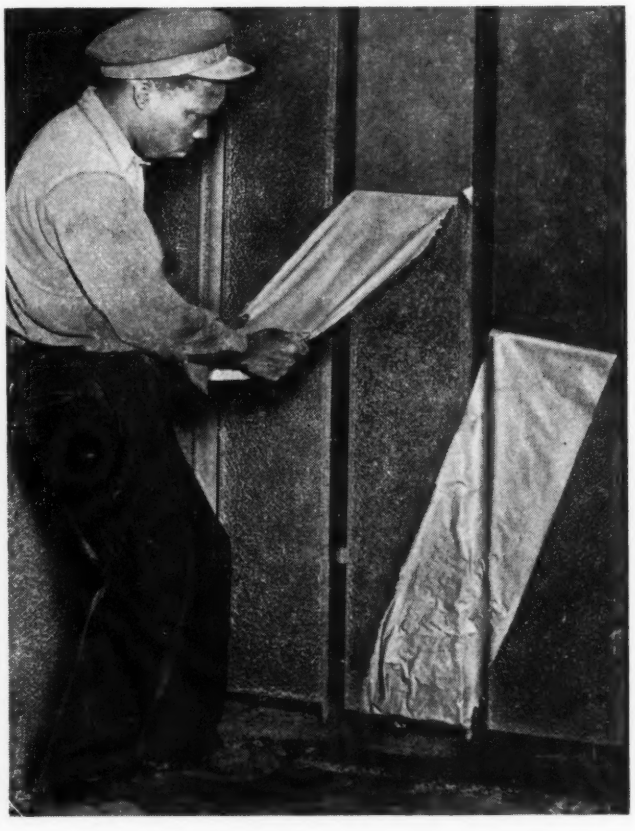
* * *

Peelable Spray-Booth Coating

A peelable plastic film for coating spray booths has been developed by Better Finishes & Coatings Inc., Newark, N. J. The material is sprayed on a clean booth in a film from 0.002 to 0.005 inch thick. When the booth is ready for cleaning, the "liquid envelope" can be quickly peeled off the metal in large sheets, carrying with it all accumulated paint, lacquer, and spray dust.



Inspecting a Complicated Machined Casting with Three-dimensional Optical Projection Equipment



Peeling a Plastic Coating from a Spray Booth to Remove Accumulated Paint, Lacquer, and Dust

To help you get SPECIAL TAPS quicker

"M-11"

*'Detroit' also stocks special blanks of "M-11" for quick grinding to your specifications.

Shown here are a few typical Detroit Tap and Tool Company M-11 *special* taps currently carried *in stock* in addition to standard taps.*

While it is obviously impossible to stock every special tap, it is our policy to maintain a floating bank of such taps for large tap users, so that they can secure immediate delivery on their re-orders.

You, too, can insure immediate delivery of your special taps and cut your own inventory requirements at the same time by specifying M-11 taps—the only taps that are made of this remarkable, long-life, tough and shock-resistant chrome cobalt high speed steel.

They cost no more! They last longer! You can get them quicker!

Radium Salts Used for Liquid Level Indication and Control

Since ordinary indicating instruments require openings in the containing tank for the installation of components, liquid-level control of corrosive combustible fluids is often difficult. To eliminate this trouble, the Electronics Laboratories, Inc., Tulsa, Okla., has perfected an electronic device called a "Gagetron" that utilizes a gamma-ray detector and a small float containing radium salts. This instrument requires no connections inside the tank.

The instrument containing the gamma-ray detector is placed on the exterior of the tank; the gamma-ray source, an iridium-platinum needle containing a minute quantity of a commercially available radium salt, is placed inside a highly corrosion-resistant float. This float remains on the liquid directly below the detector. As the gamma-ray absorption factor of the vessel wall directly below the detector is constant, and as the absorption factor of the gas, air, or vapor above the liquid is negligible, the strength of the gamma ray at the detector is inversely proportional to the square of the distance between it and the gamma-ray source. The rays, upon striking the detector (a counter of the Geiger-Mueller type), set up minute electrical pulses. The rate of these electrical pulses is an indication of the distance between the source and counter—hence of the liquid level.

These minute electrical pulses are amplified, integrated, and rectified to produce direct current, the value of which is proportional to the number of gamma rays per unit time. A feedback circuit has been incorporated in the device to produce a direct-current value that approaches a linear relationship to the distance between the source and the detector, and simplifies measurement of high and low gamma-ray intensities at the detector. Thus, the measured value of the current is readily converted into height of the liquid level, expressed in feet and inches.

Tests Being Made on Aerial Television

The second stages of tests on airborne FM (frequency modulation) radio broadcasting and first tests of aerial television, or "Stratovision," were recently begun by the Glenn L. Martin Co. and the Westinghouse Electric Corporation, working in cooperation. A B-29 airplane has been modified to take the necessary equipment, which is being designed and built by Westinghouse, and the panels are being installed as fast as completed. The U. S. Air Force is also collaborating in the plans, as during flights tests will be conducted on some new types of military electronic equipment. To make possible complete tests, the Air Force is using a second B-29 which will make ground-to-air, air-to-air, and air-to-ground communications available.

* * *

The steel plants of the United States require every day a trainload of material 133 miles long.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946, of MACHINERY, published monthly at New York 13, N. Y., for October 1, 1947.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the state and county aforesaid, personally appeared Edgar A. Becker, who, having been duly sworn according to law, deposes and says that he is the treasurer of The Industrial Press, Publishers of MACHINERY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Acts of March 3, 1933, and July 2, 1946, (section 537, Postal Laws and Regulations), printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editors, managing editor, and business managers are: Publisher, The Industrial Press, 148 Lafayette Street, New York 13, N. Y.; Editor, Charles O. Herb; Consulting Editors, Erik Oberg and Franklin D. Jones; Business Managers, Robert B. Luchars, Edgar A. Becker and Harold L. Gray. The address of all the foregoing is 148 Lafayette Street, New York 13, N. Y.

2. That the owners of 1 per cent or more of the total amount of stock are: The Industrial Press, Robert B. Luchars, Edgar A. Becker, Franklin D. Jones, Walter E. Robinson, Charles O. Herb, and Harold L. Gray, all of 148 Lafayette Street, New York 13, N. Y.; Helena E. Oberg, 65 Eighty-second St., Brooklyn 9, N. Y.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; First National Bank & Trust Co. of Montclair and Robert B. Luchars, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank & Trust Co. of Montclair and Leigh Roy Urban, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank & Trust Co. of Montclair and Kenneth D. Ketchum, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; Paterson Savings & Trust Co., Trustee (Beneficiaries unknown), Paterson, N. J.; Lee W. Urban, Guardian for Susan Yarnall Urban, 27 Clinton St., Oneonta, N. Y., and Lee W. Urban, Executrix of Will of Robert L. Urban, 27 Clinton St., Oneonta, N. Y.

3. That the known bondholders, mortgagees, and other security holders are: Charlotte B. Baldwin, 420 Clinton Ave., Brooklyn, N. Y.; Robert B. Luchars, John Connolly, Franklin D. Jones, and Louis Pelletier, all of 148 Lafayette St., New York 13, N. Y.; Elizabeth Y. Urban, 163 Western Drive, Longmeadow 6, Mass.; Helen L. Ketchum, 231 King St., Cohasset, Mass.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; and Henry V. Oberg, 3375 Kenmore Road, Shaker Heights 22, Ohio.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDGAR A. BECKER, Treasurer

Sworn to and subscribed before me this 1st day of October, 1947

(SEAL)

CHARLES P. ABEL
Notary Public, State of New York
Residing in Kings Co. No. 300, Reg. No. 116-A-9
Cert. filed in N. Y. Co No. 115, Reg. No. 153-A-9
Commission expires March 30, 1949